DAMOS

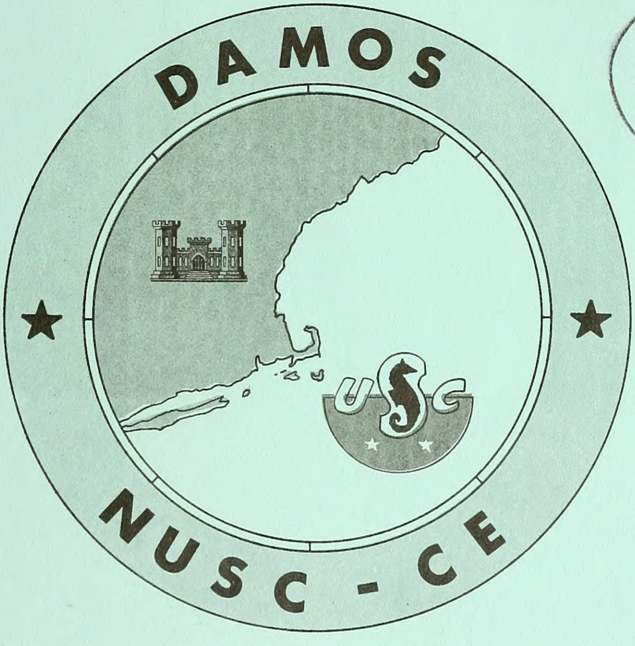
DISPOSAL AREA MONITORING SYSTEM
ANNUAL DATA REPORT - 1978

SUPPLEMENT G

CORNFIELD SHOALS DISPOSAL SITE

Naval Underwater Systems Center
Newport, Rhode Island

WHOI
DOCUMENT
COLLECTION



New England Division
Corps of Engineers
Waltham, Massachusetts

May 1979

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DAMOS

DISPOSAL AREA MONITORING SYSTEM
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SUPPLEMENT G
SITE REPORT - CORNFIELD SHOALS

Naval Underwater Systems Center
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MBL/WHOI
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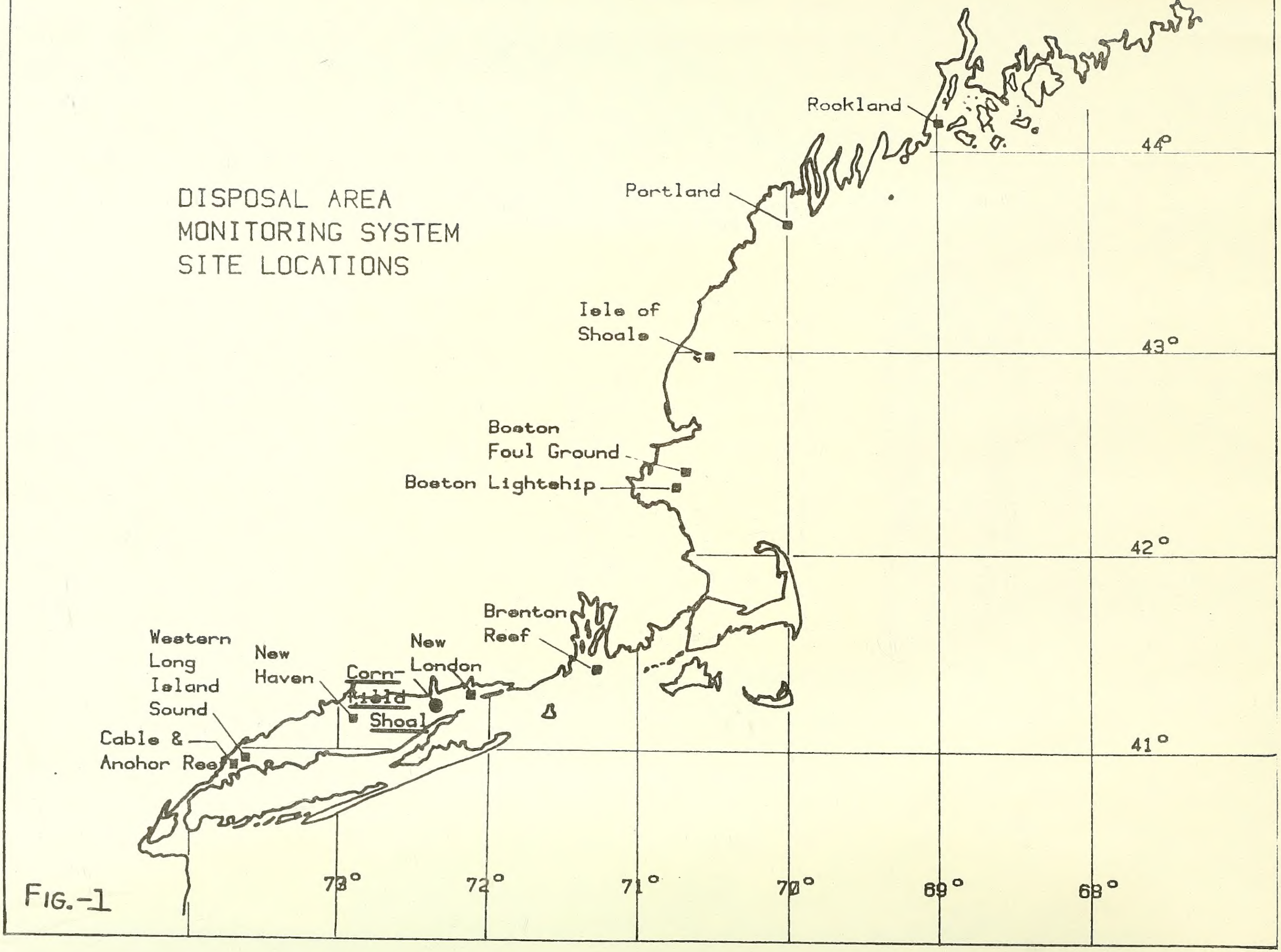


DISPOSAL AREA
MONITORING SYSTEM
SITE LOCATIONS

FIG.-1

DISPOSAL AREA MONITORING SYSTEM

This is one of a series of site specific data reports resulting from the DAMOS program, now two years in progress. DAMOS is the culmination of nearly a decade of prior study efforts, actually preceding NEPA, which have been directed towards the understanding of the effects of and the responsible management of the ocean disposal of dredged materials in New England waters as they fall under the authority ot the New England Division of the Corps of Engineers. The individual site reports henceforth will be updated approximately on an annual bases as additional knowledge is gained, at least with respect to those sites where significant disposal activities will have occurred.

CORNFIELD SHOALS

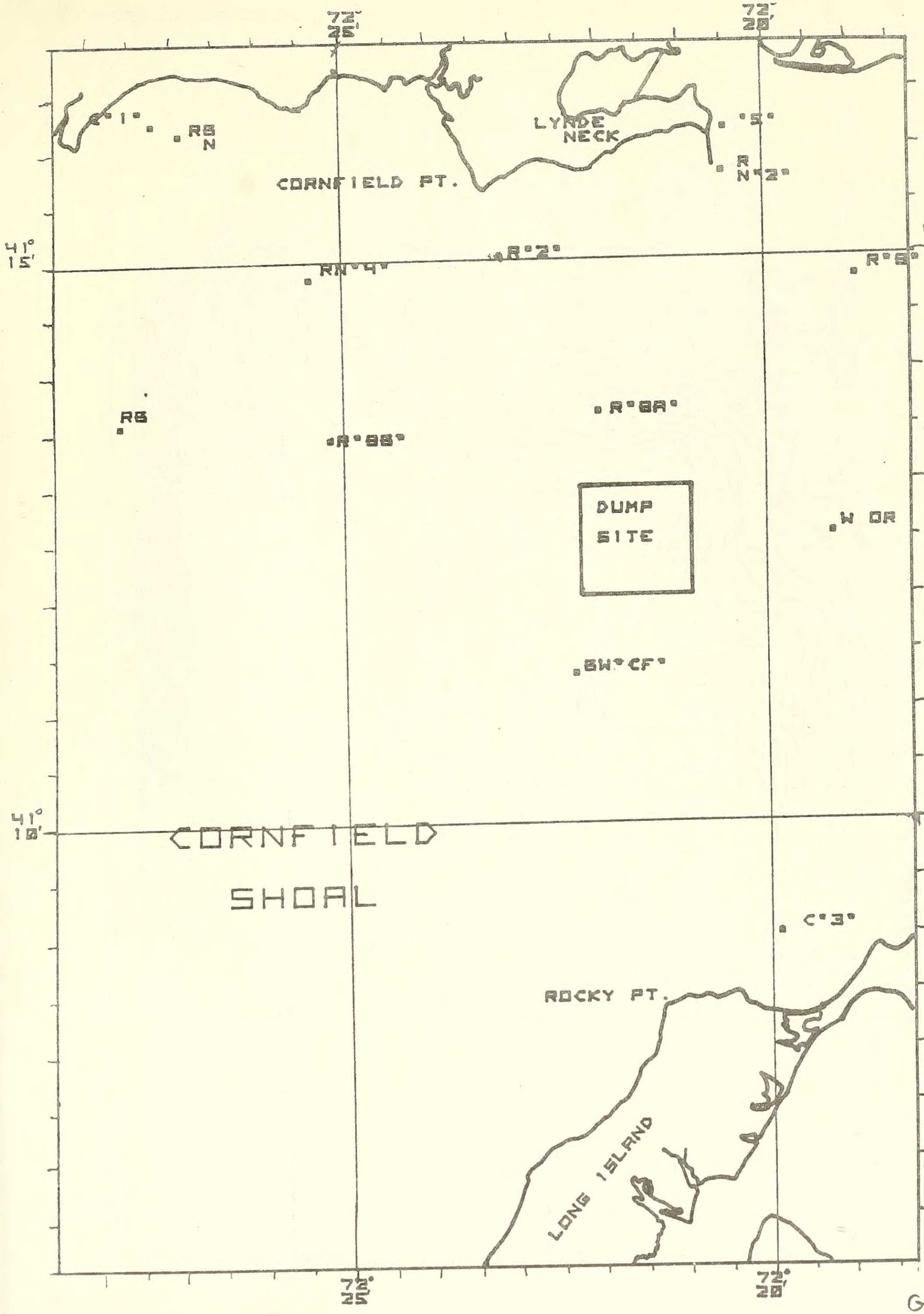
The Cornfield Shoals disposal site (Fig. G-1) is located 6.5 km south southwest of the entrance to the Connecticut River, approximately in the middle of Long Island Sound. This site has been used in recent months for the disposal of spoils from the North Cove project in Old Saybrook, Conn. Sediments in the area are generally clean sands with some gravel present in isolated areas.

Bathymetry

Navigation control for operations at the Cornfield Shoals site is provided by trisponder stations installed at the Old Saybrook Lighthouse at the entrance to the Connecticut River and at the Lyme Point Lighthouse farther west. Two surveys have been made at the Cornfield Shoals site; the first on January 30, 1978, (Figure G-2(a-k)) and the second on July 30, 1978 (Figure G-3(a-k)). Both of these surveys depict the disposal site as a gentle depression in the center of the site, with a relatively steep slope to a shoal area on the southern margin.

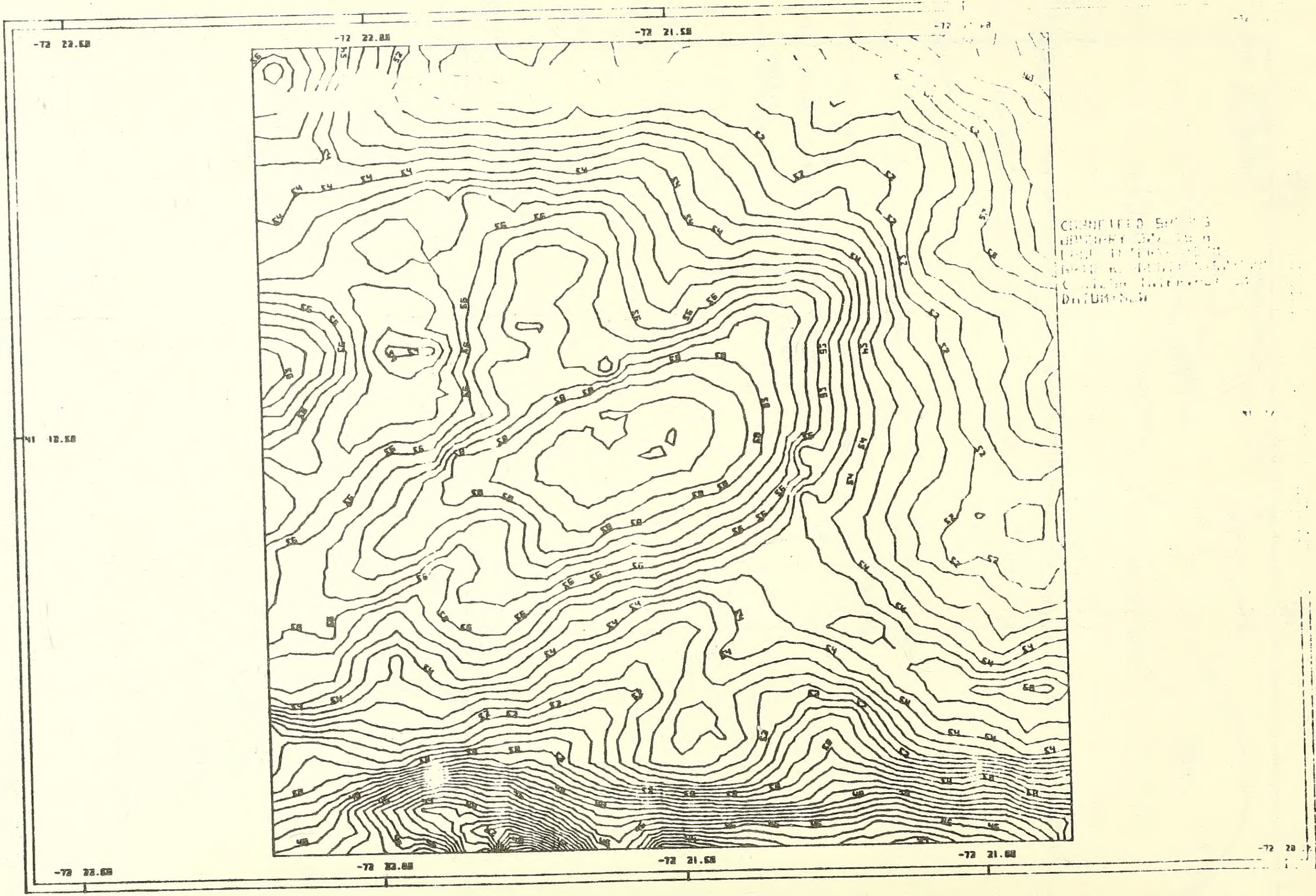
There is, however, a 1.5 meter discrepancy between these two surveys such that the July survey is more shallow. This is a constant offset in the data, since all contours and profile plots have essentially the same features and the offset is the same for all profiles negating a mistake in the tidal corrections. It appears that a draft correction was probably not applied to the July survey, however, this cannot be confirmed until another survey has been completed.

In spite of the correction problem the bathymetric data at Cornfield Shoals is incapable of defining the presence of a spoil mound at this site. Although point dumping was used at this site, the spoils have not formed a distinctive topographic feature on the bottom. Furthermore, side scan sonar surveys in this area have failed to detect any change in the bottom indicative of spoil material.



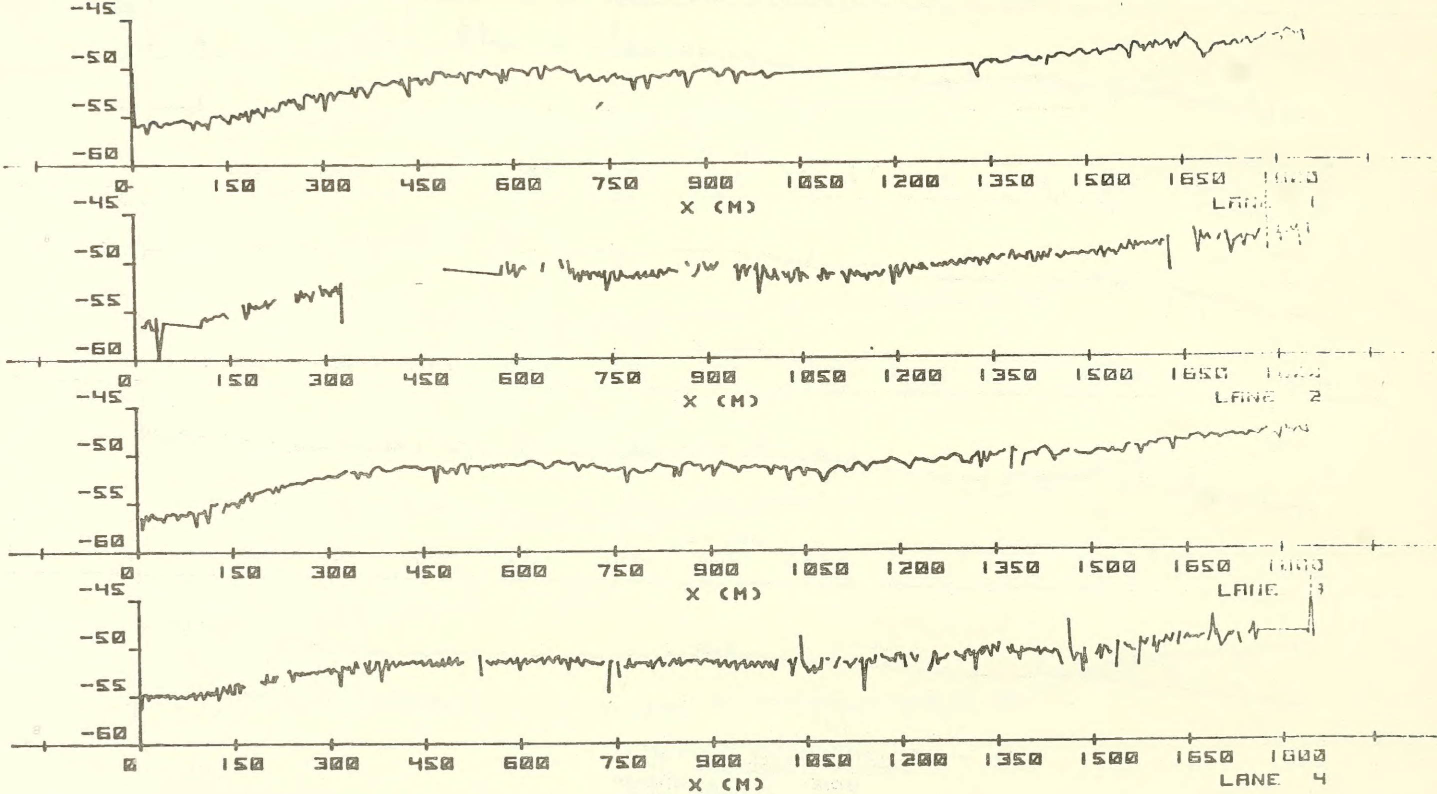
72° 25'
72° 20'
41° 15'
41° 10'
"1"
RB N
LYNDE NECK
"5"
R N "2"
CORNFIELD PT.
R "2"
RN "4"
R "6"
RB
R "8A"
R "8B"
DUMP SITE
W OR
BW "CF"
CORNFIELD SHOAL
C "3"
ROCKY PT.
LONG ISLAND

G-1

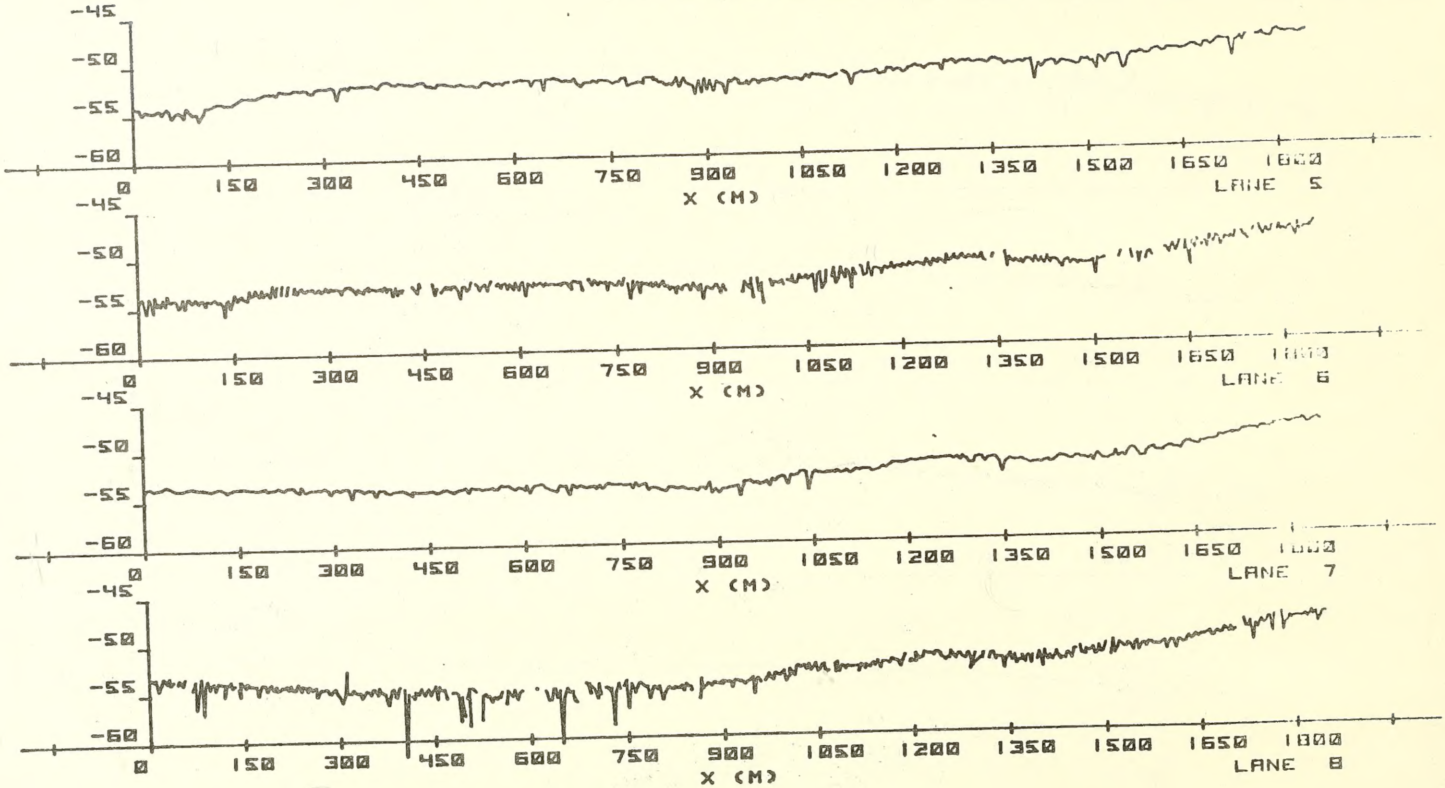


G-2A

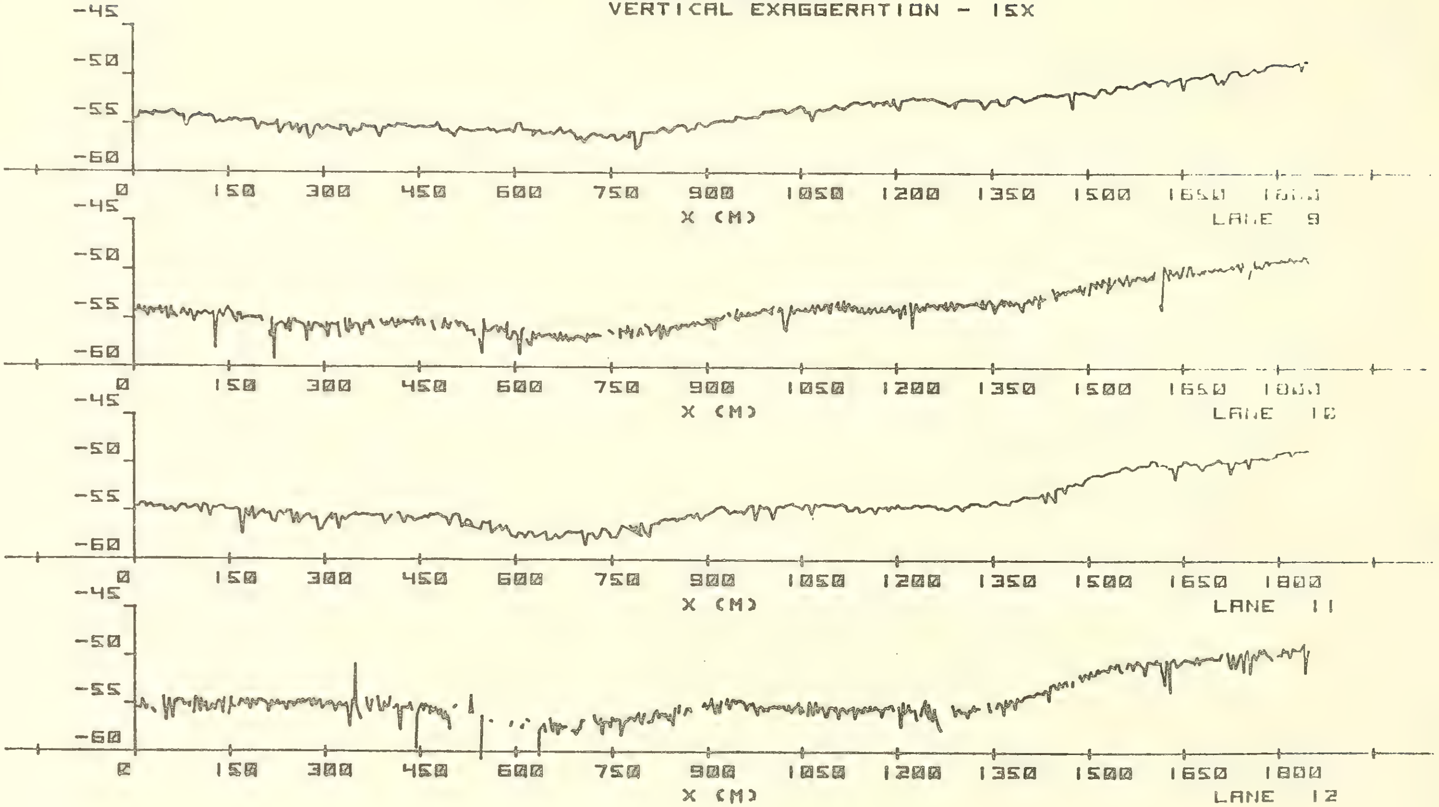
CORNFIELD SHOALS
JANUARY 30, 1978
LANE INTERVAL - 50M
VERTICAL EXAGGERATION - 15X

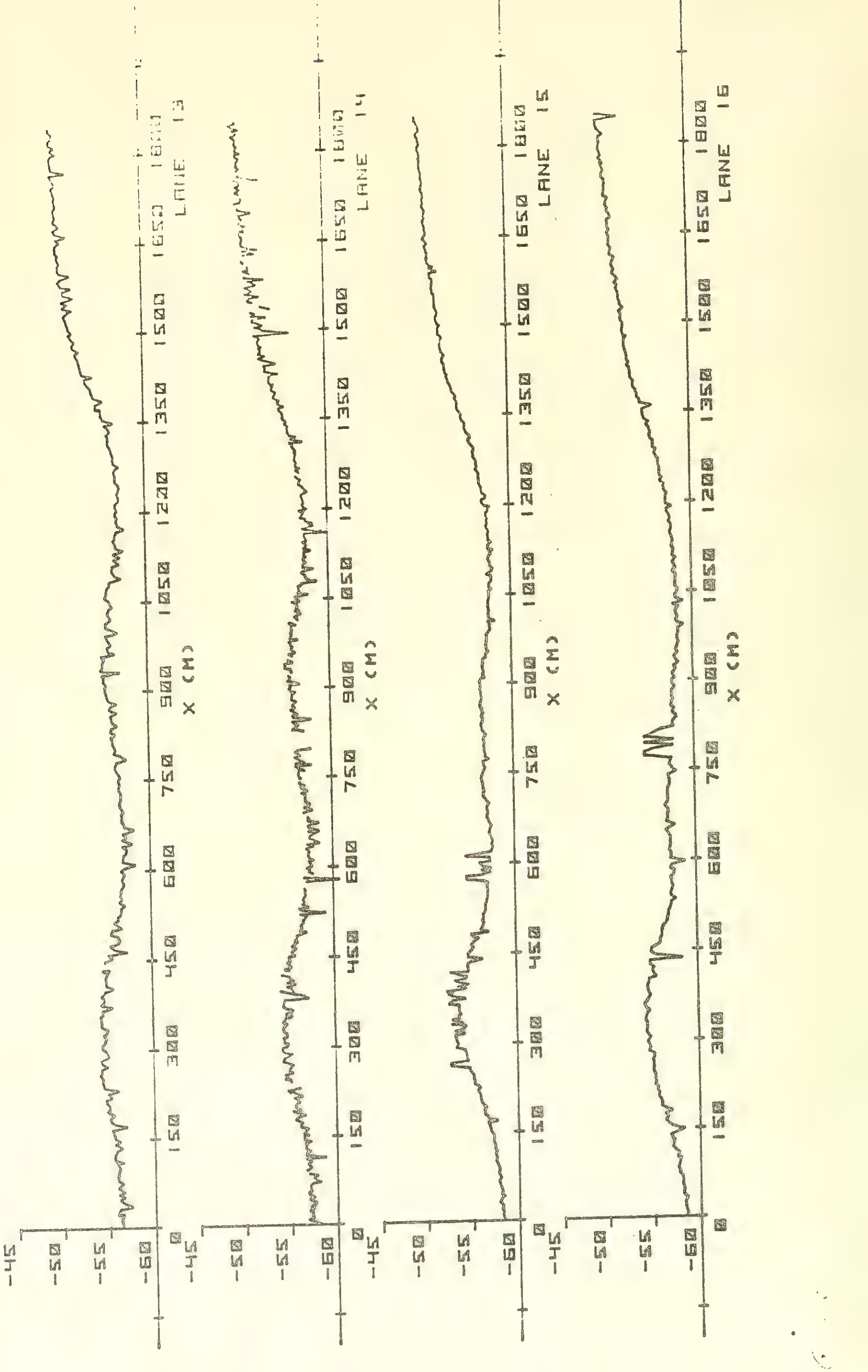


CORNFIELD SHOALS
JANUARY 30, 1978
LANE INTERVAL - 50M
VERTICAL EXAGGERATION - 15X

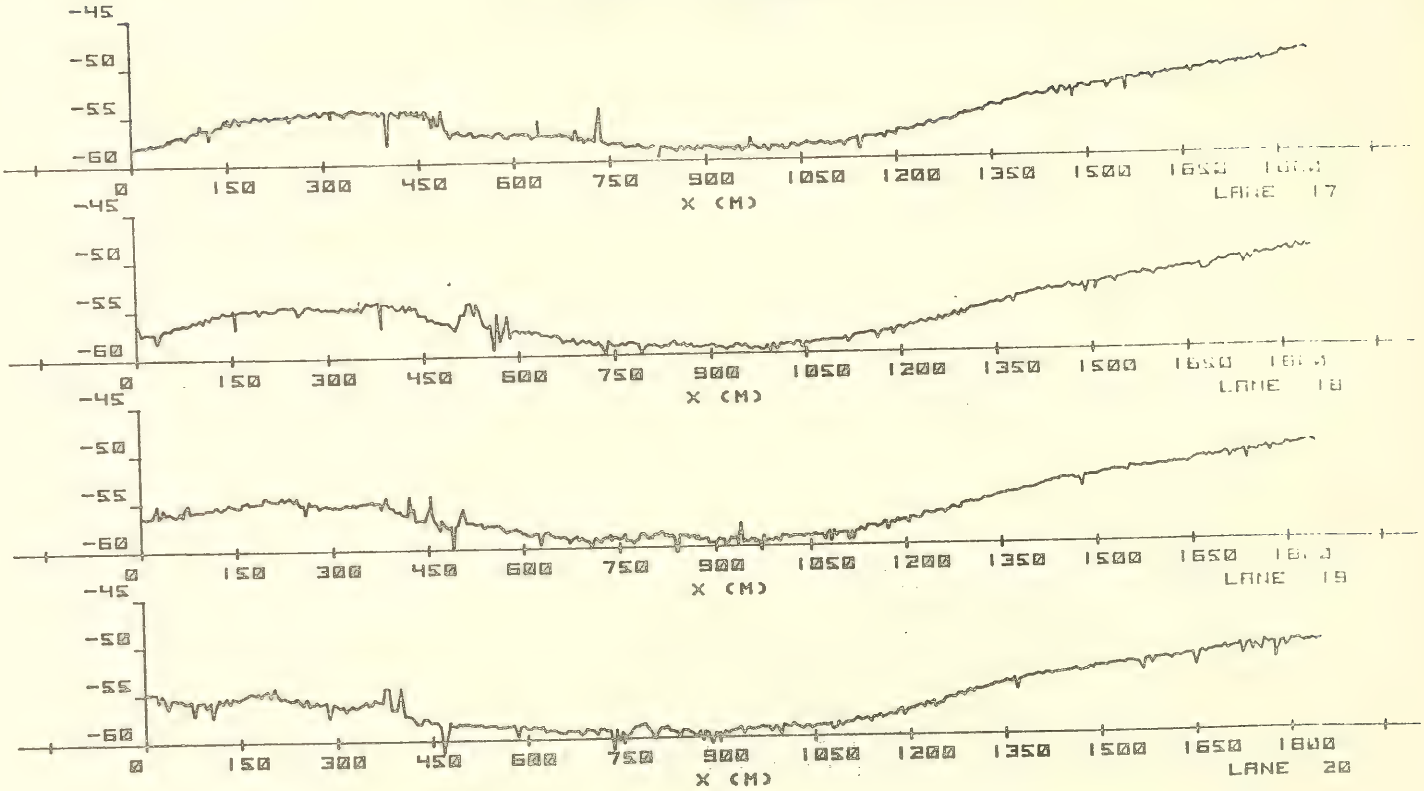


CORNFIELD SHOALS
JANUARY 30, 1978
LANE INTERVAL - 50M
VERTICAL EXAGGERATION - 15X

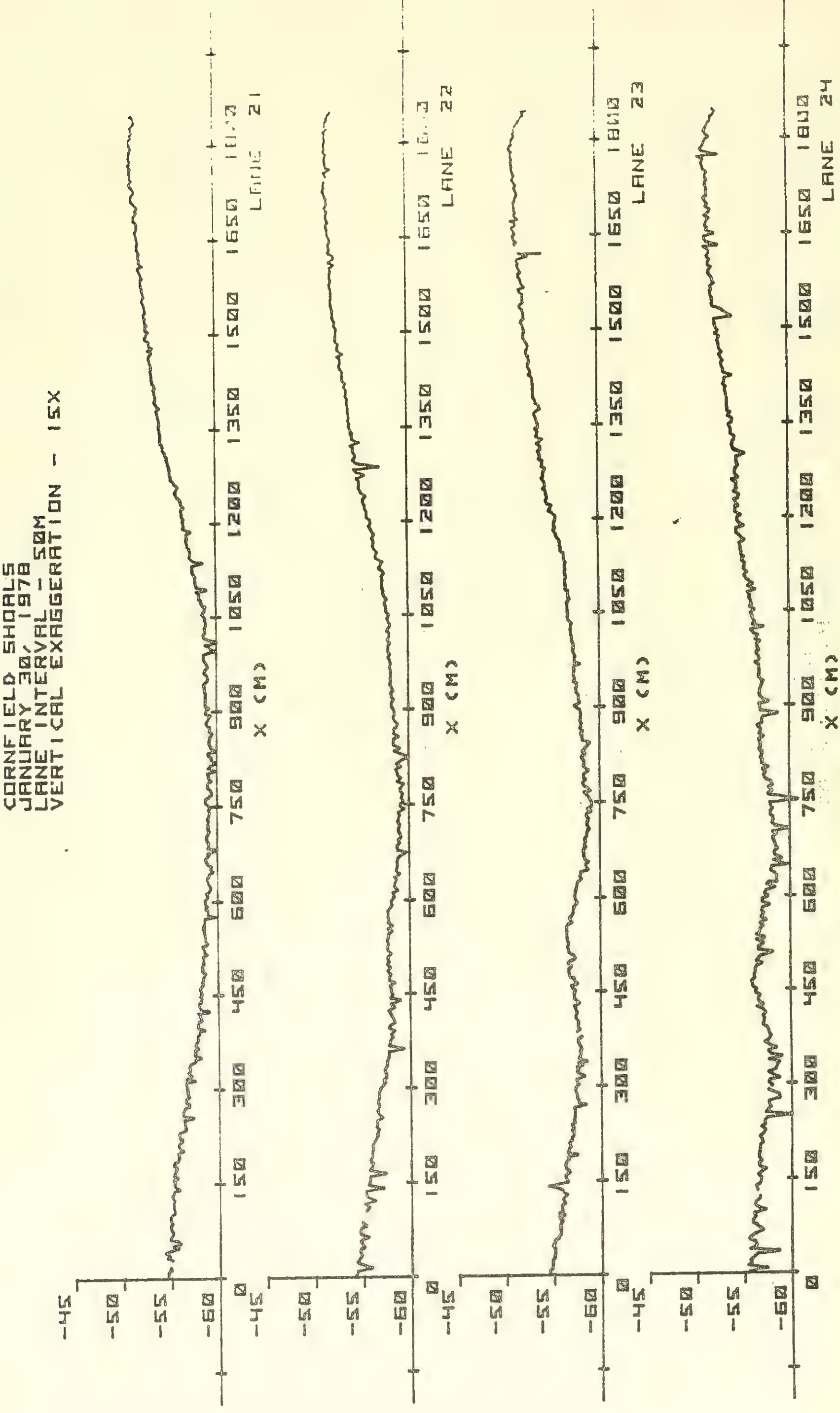



LANE 13
LANE 14
LANE 15
LANE 16
X (M)
0
150
300
450
600
750
900
1050
1200
1350
1500
1650
1800
-45
-50
-55
-60

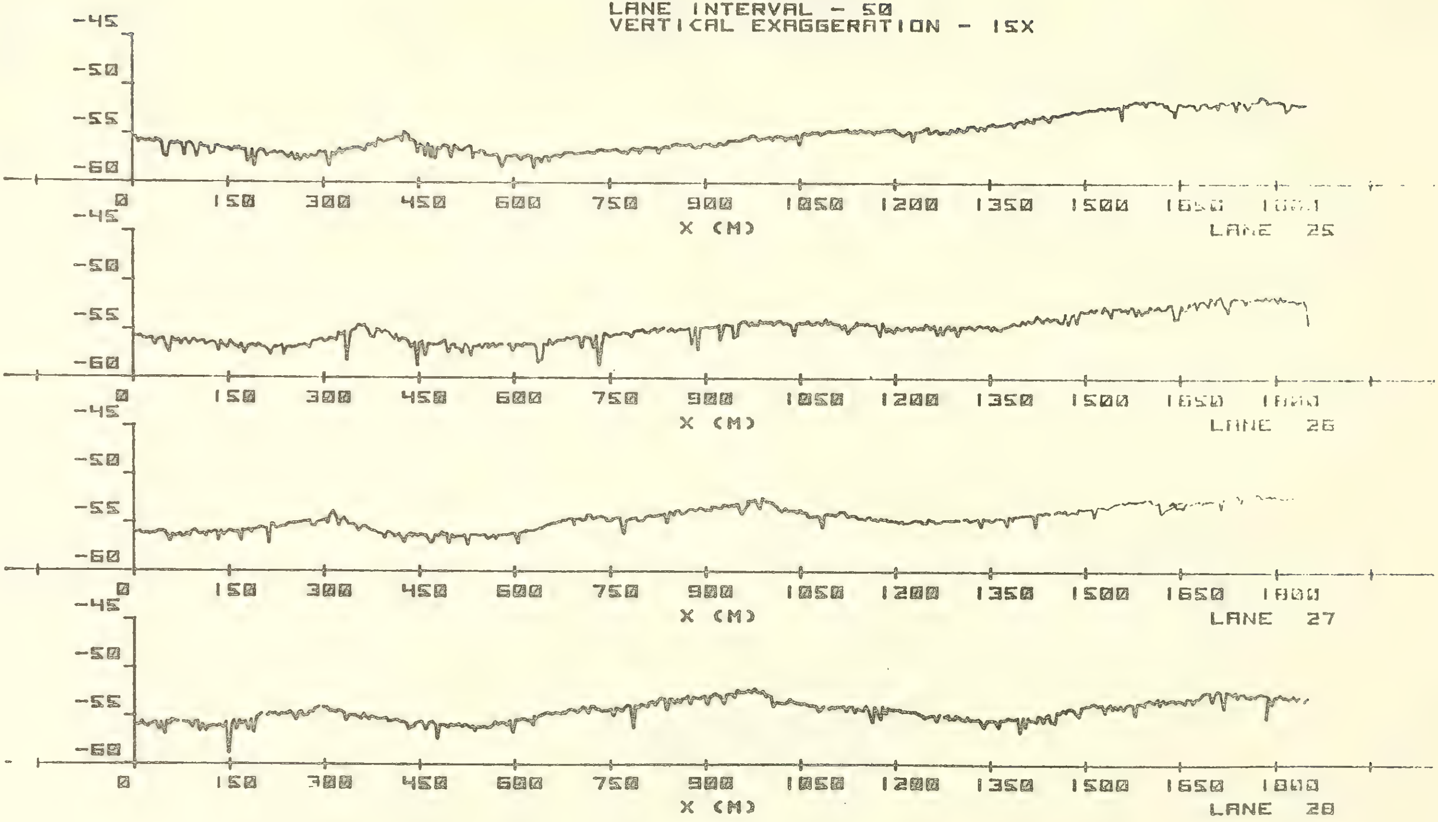
CORNFIELD SHOALS
JANUARY 30, 1978
LANE INTERVAL - 50M
VERTICAL EXAGGERATION - 15X

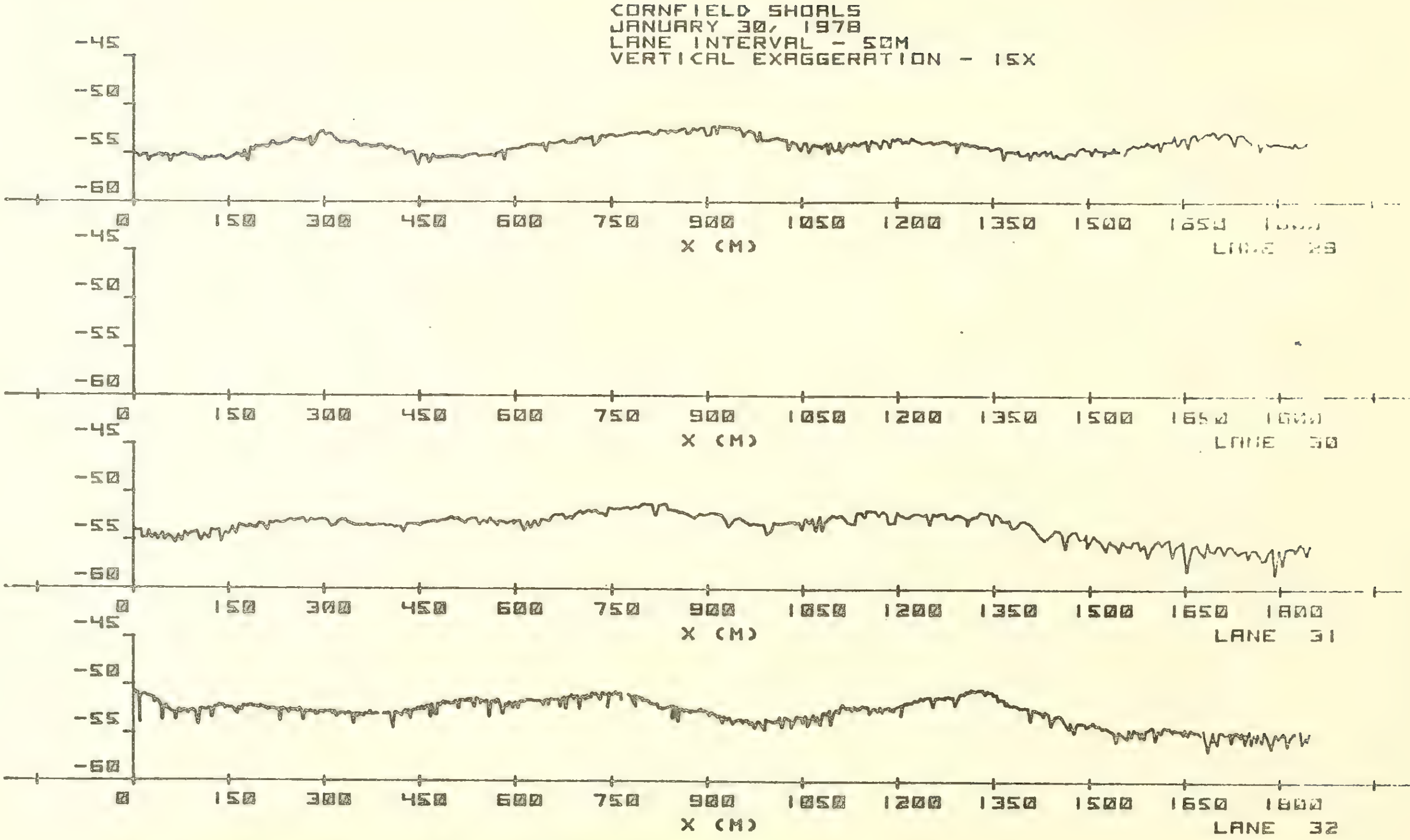


6·2F


CORNFIELD SHOALS
JANUARY 30, 1978
LANE INTERVAL - 50M
VERTICAL EXAGGERATION - 15X
LANE 21
LANE 22
LANE 23
LANE 24
X (M)
0
150
300
450
600
750
900
1050
1200
1350
1500
1650
1800
-45
-50
-55
-60

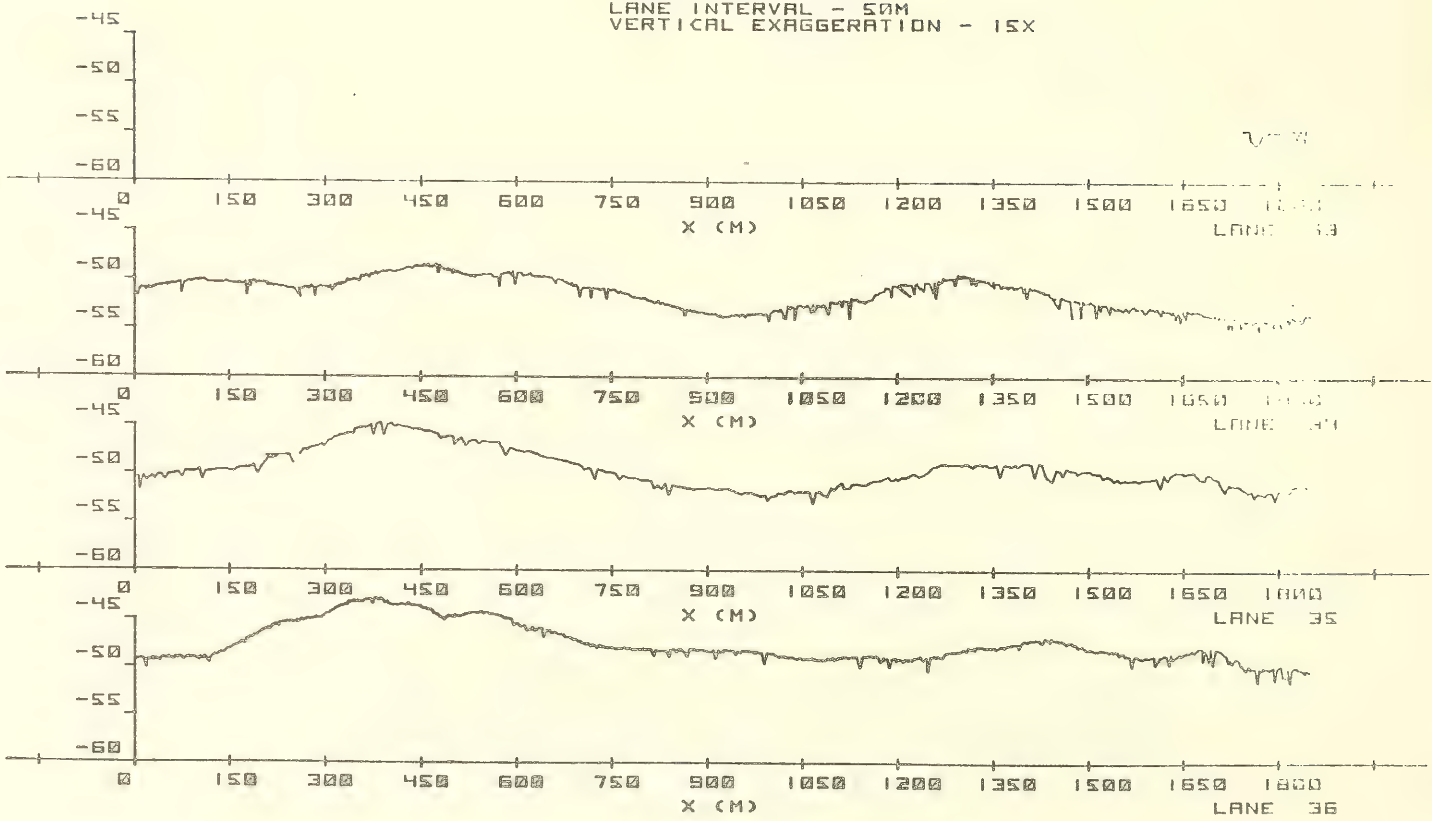
CORNFIELD SHOALS
JANUARY 30, 1978
LANE INTERVAL - 50
VERTICAL EXAGGERATION - 15X

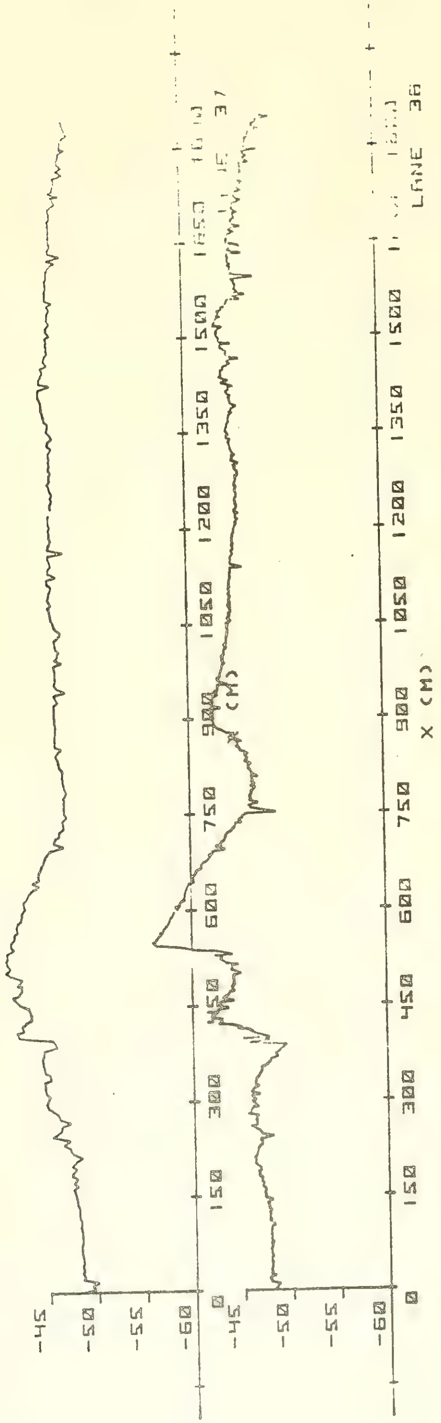




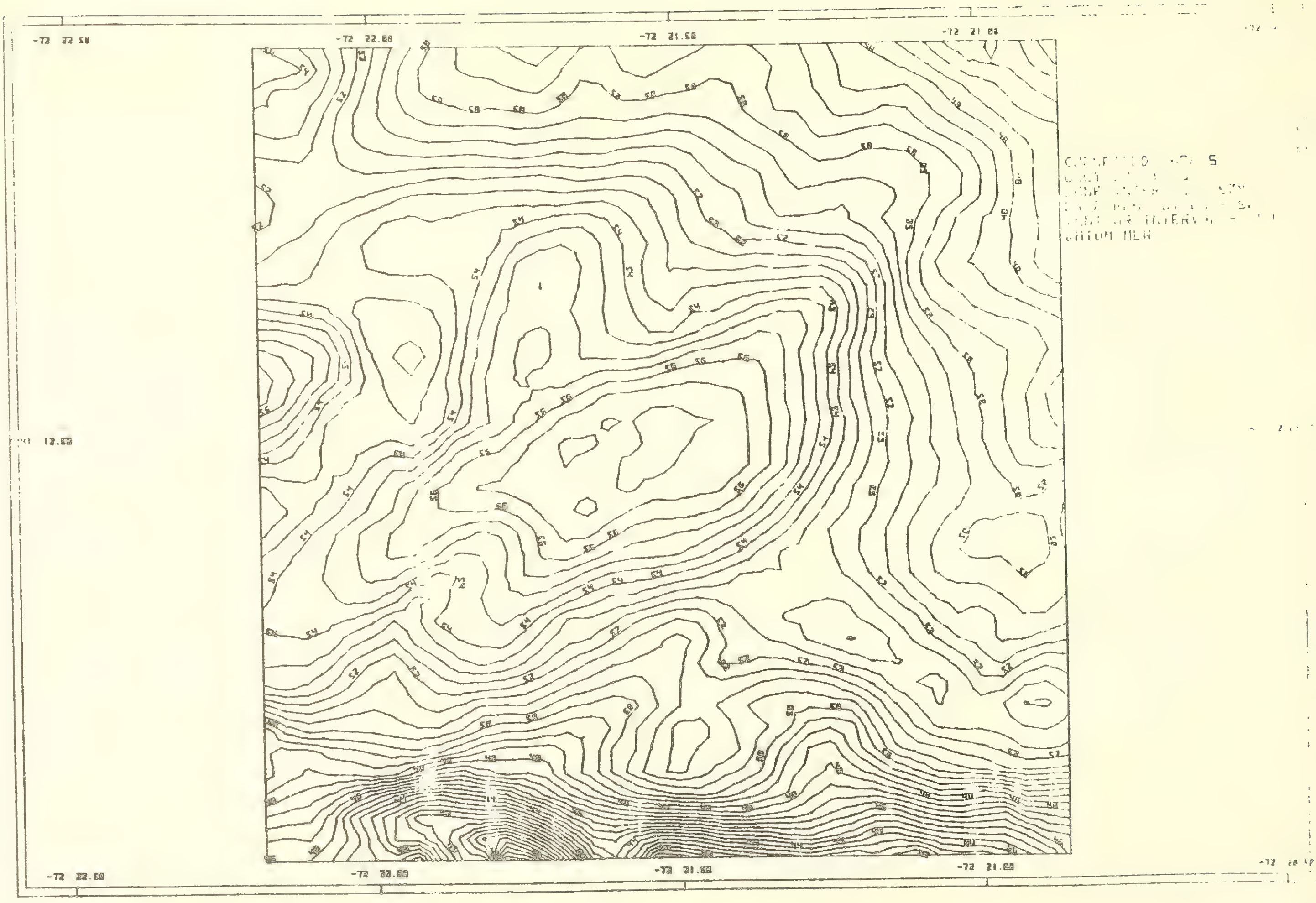
CORNFIELD SHOALS
JANUARY 30, 1978
LANE INTERVAL - 50M
VERTICAL EXAGGERATION - 15X

CORNFIELD SHOALS
JANUARY 30, 1978
LANE INTERVAL - 50M
VERTICAL EXAGGERATION - 15X

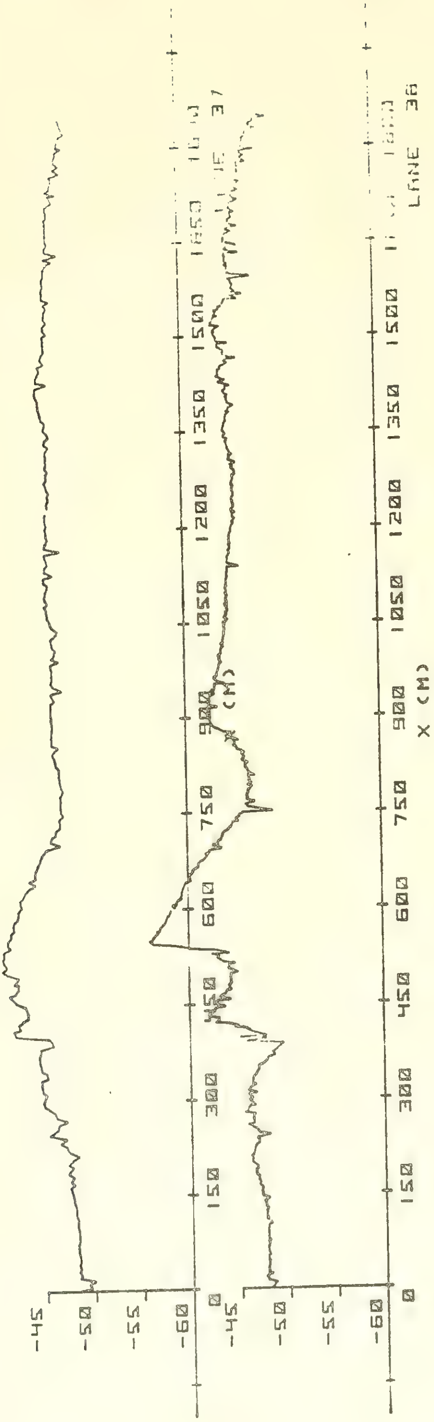


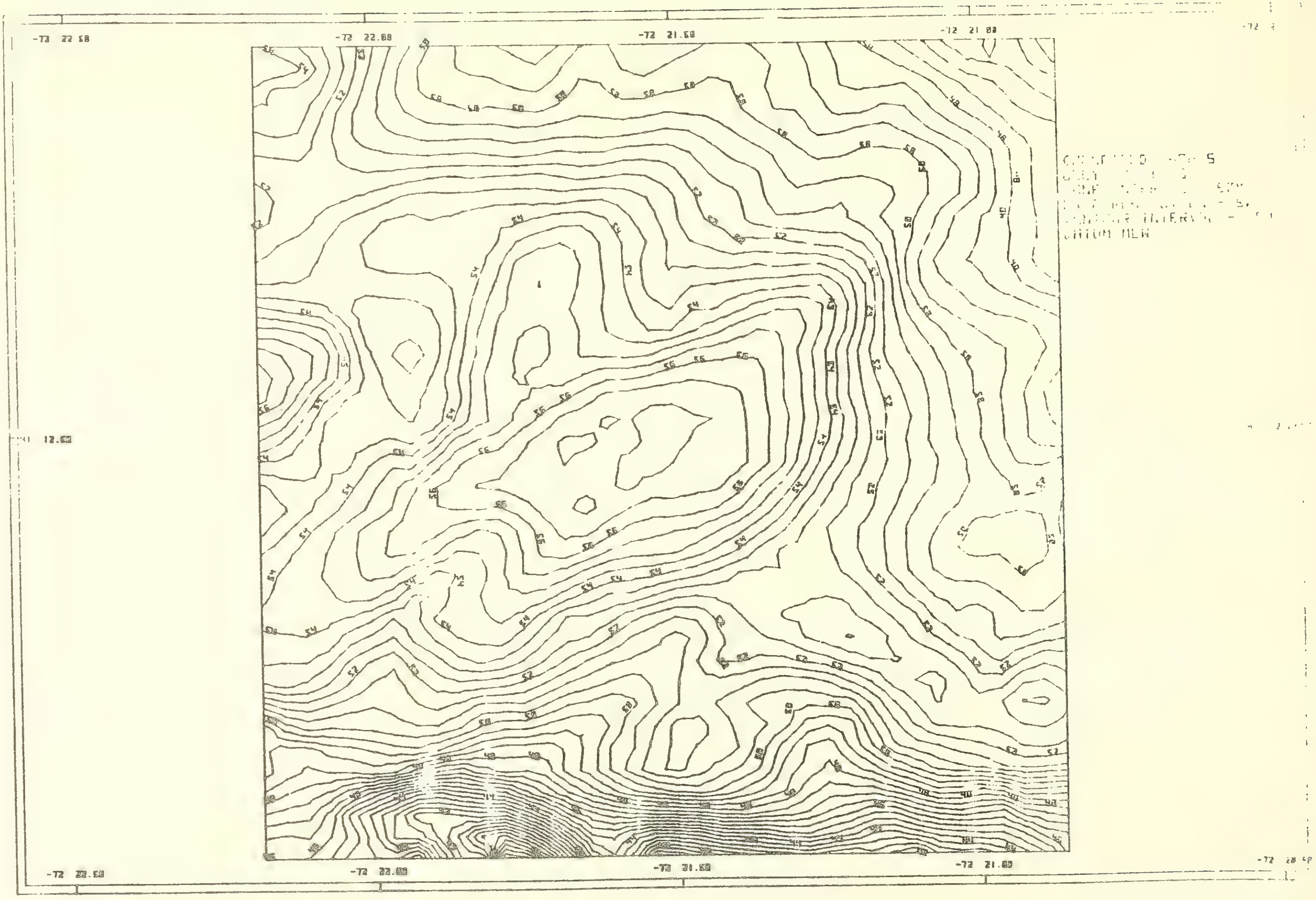

-45
-50
-55
-60
0
150
300
450
600
750
900
1050
1200
1350
1500
1650
X (M)
LANE 37
-45
-50
-55
-60
0
150
300
450
600
750
900
1050
1200
1350
1500
1650
X (M)
LANE 36

6-2K


-72 22.50
-72 22.00
-72 21.50
-72 21.00
12.00
CONTOUR INTERVAL
DATUM MLW
58
56
54
52
50
48
46
44

6-3A

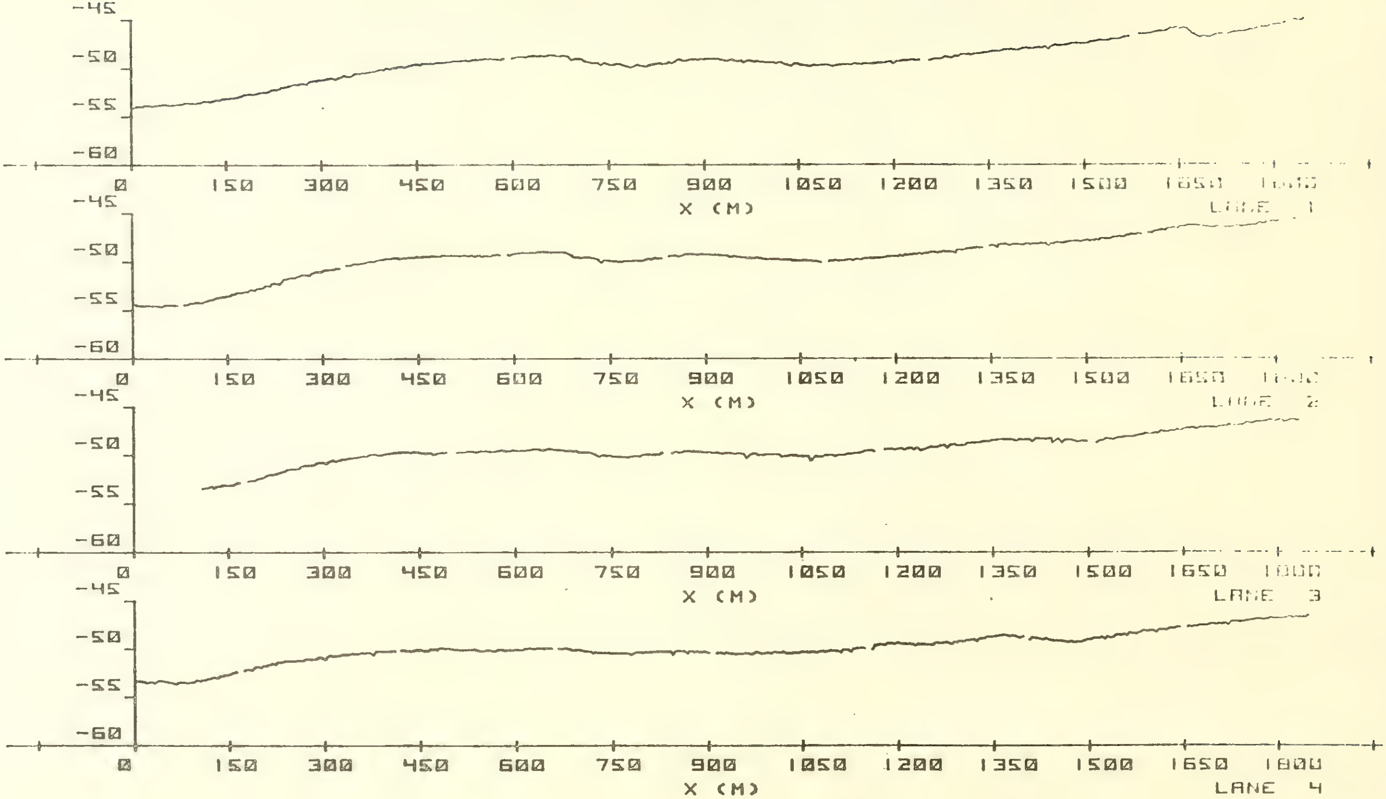

-45
-50
-55
-60
-45
-50
-55
-60
0
150
300
450
600
750
900
1050
1200
1350
1500
1650
1800
X (M)
LINE 37
LINE 38

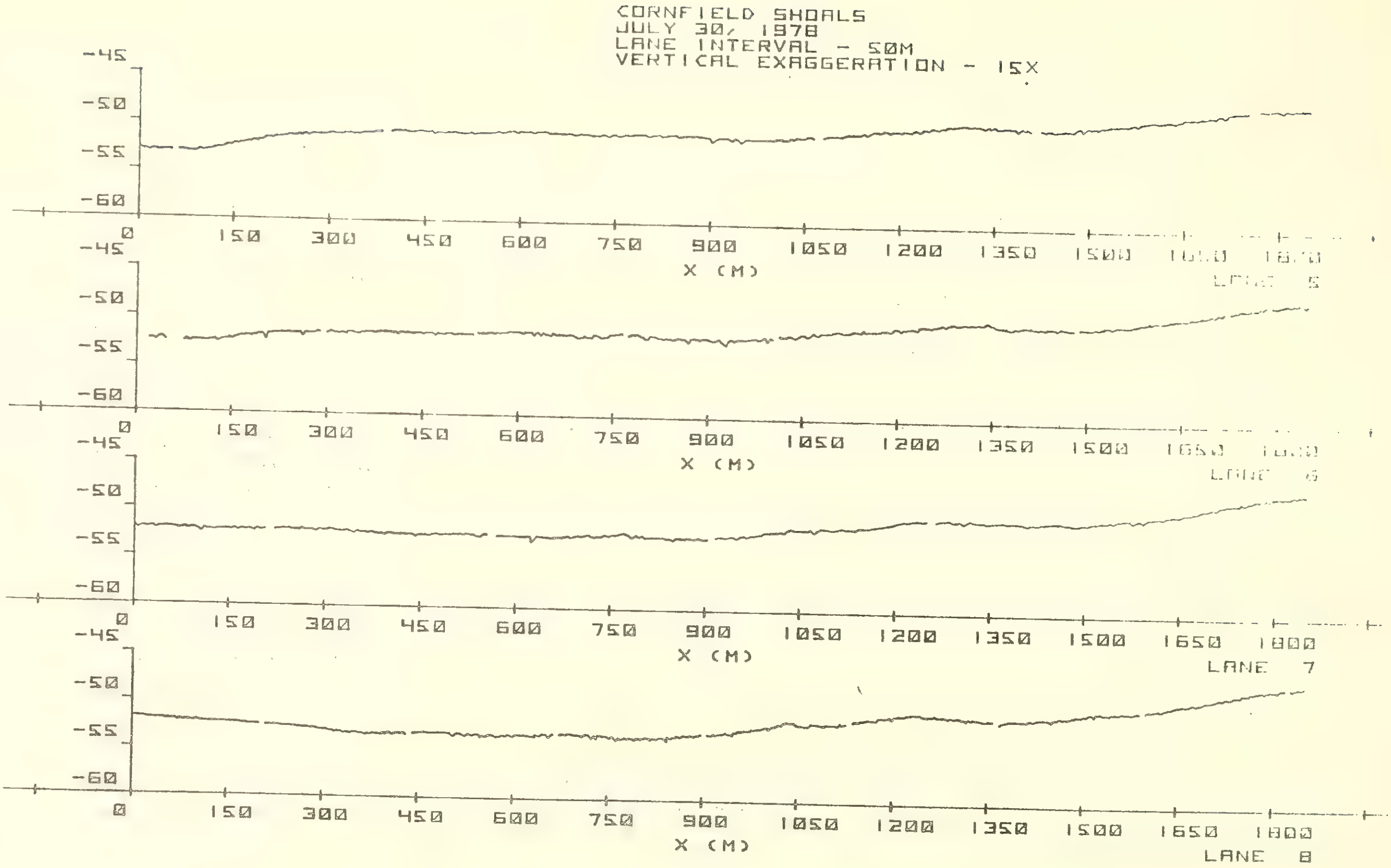


[illegible] 5
[illegible]
[illegible]
[illegible]
[illegible] INTERVAL [illegible]
DATUM MEAN

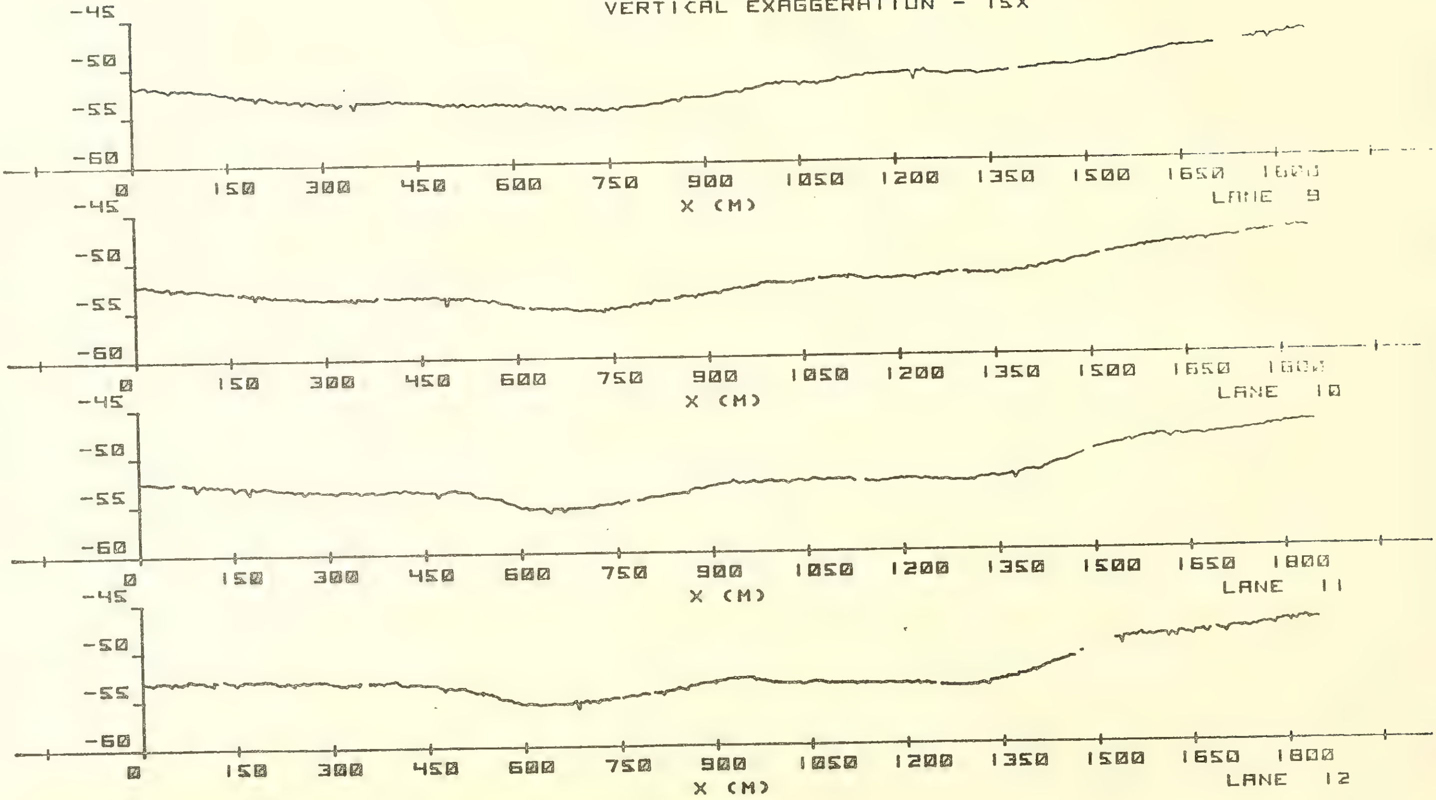
6-3A

CORNFIELD SHOALS
JULY 30, 1978
LANE INTERVAL - 50M
VERTICAL EXAGGERATION - 15X

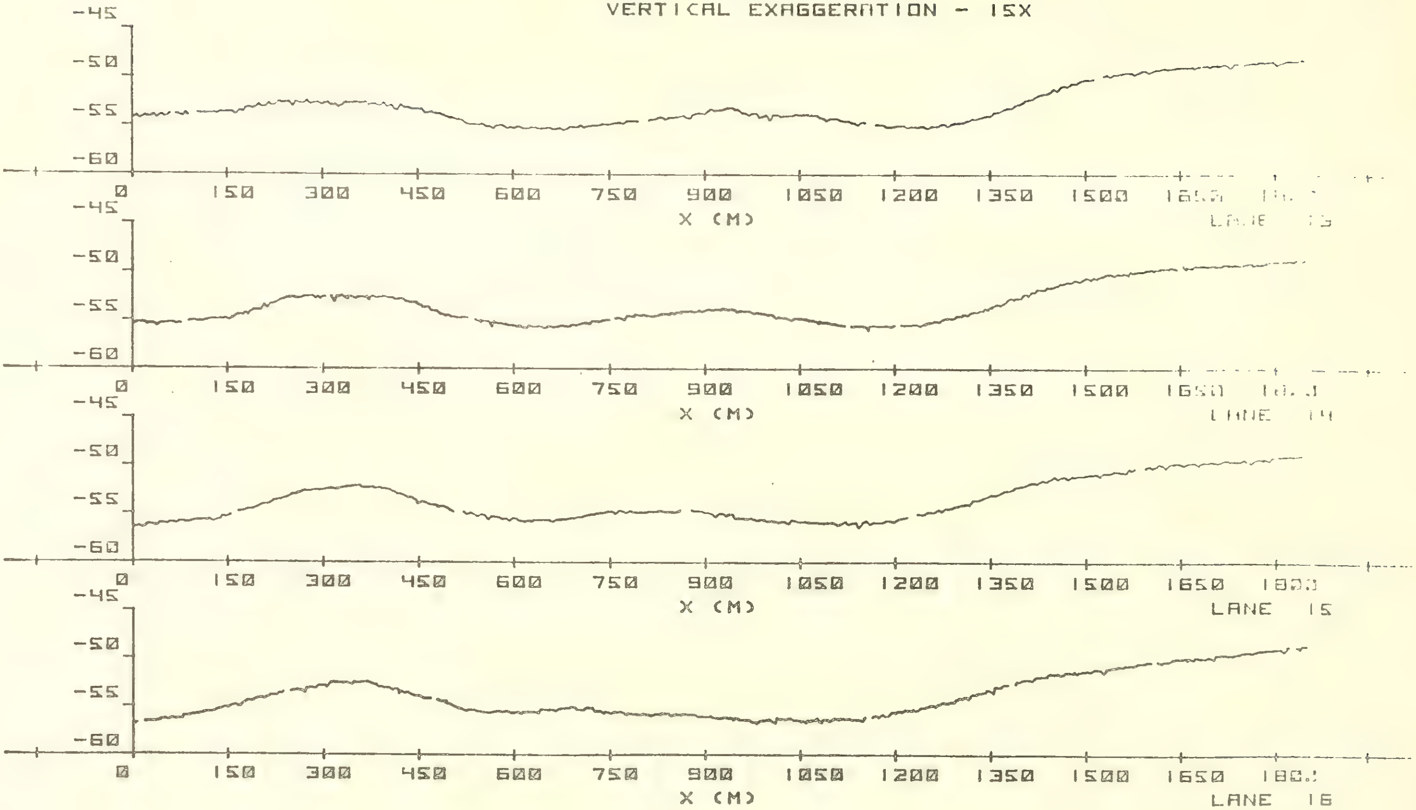


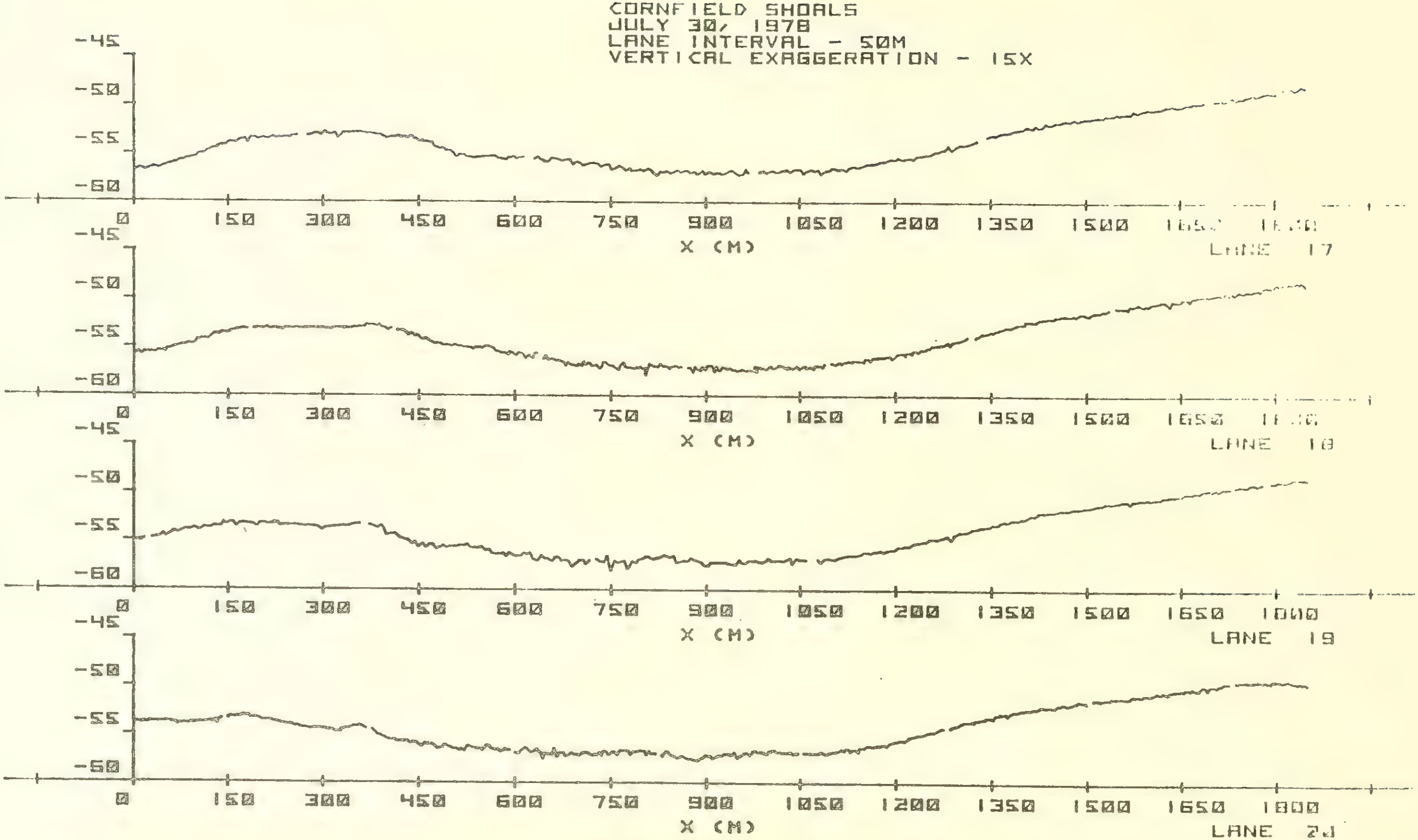
CORNFIELD SHOALS
JULY 30, 1978
LANE INTERVAL - 50M
VERTICAL EXAGGERATION - 15X
-45
-50
-55
-60
0
150
300
450
600
750
900
1050
1200
1350
1500
1650
1800
X (M)
LANE 5
LANE 6
LANE 7
LANE 8

CORNFIELD SHOALS
JULY 30, 1978
LANE INTERVAL - 50M
VERTICAL EXAGGERATION - 15X



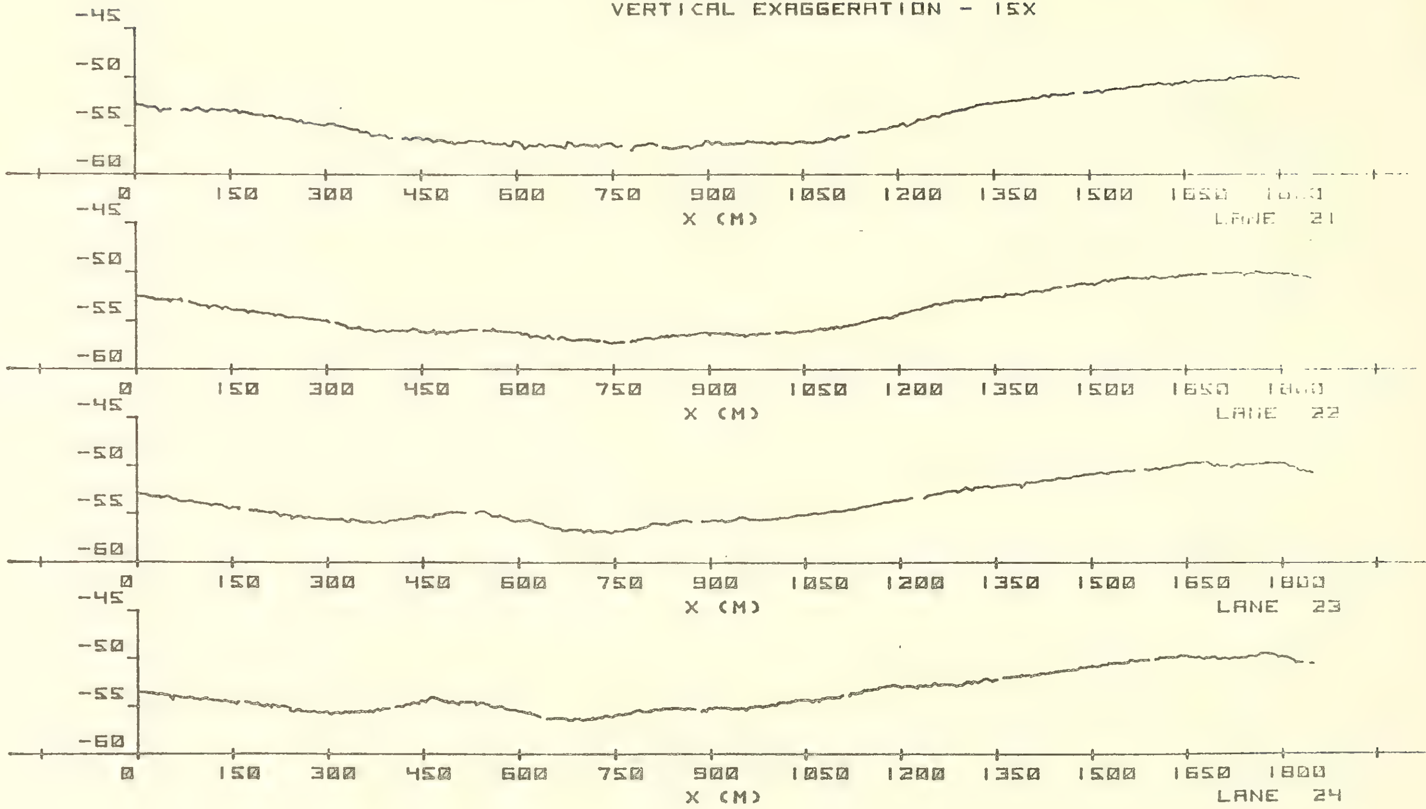
CORNFIELD SHOALS
JULY 30, 1978
LANE INTERVAL - 50M
VERTICAL EXAGGERATION - 15X



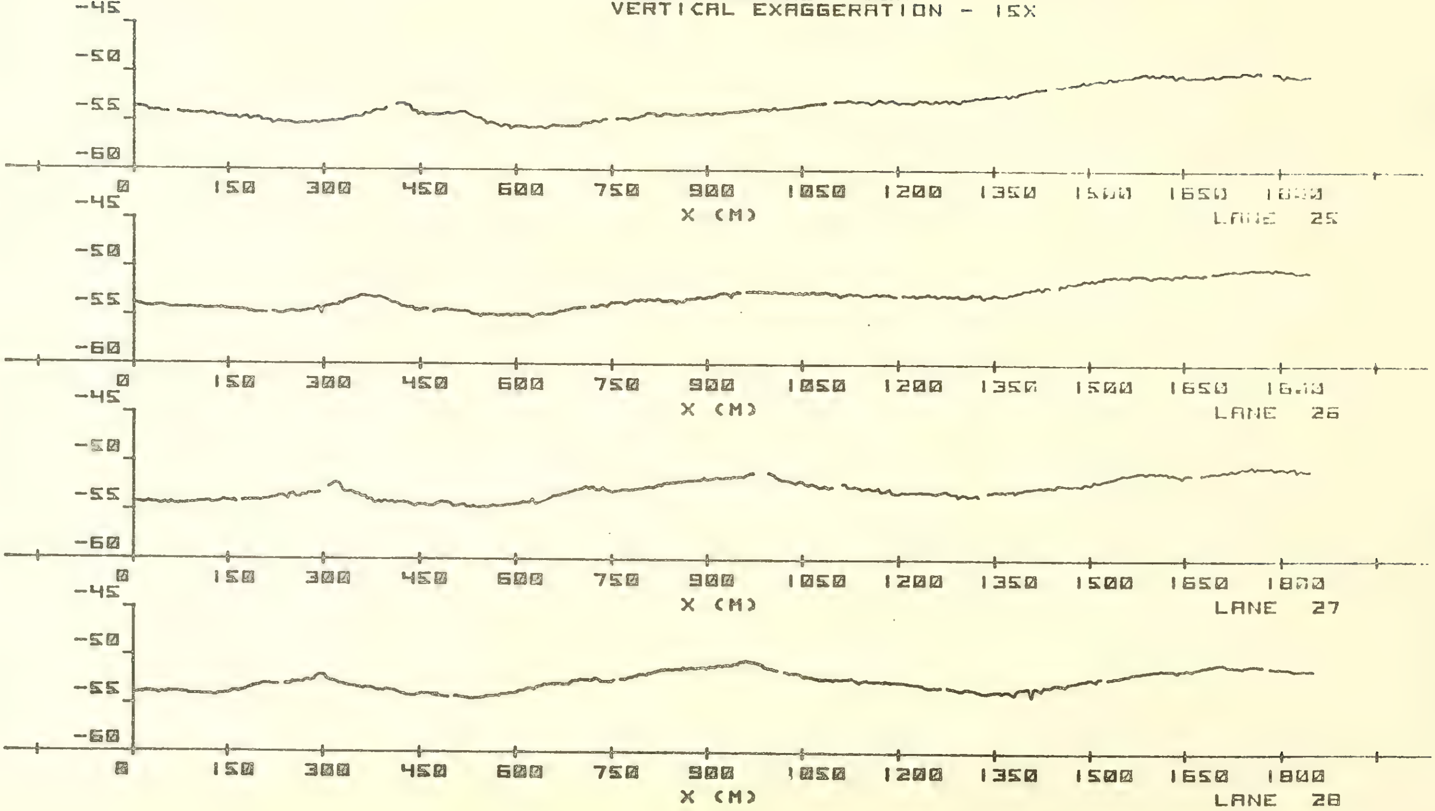

CORNFIELD SHOALS
JULY 30, 1978
LANE INTERVAL - 50M
VERTICAL EXAGGERATION - 15X
-45
-50
-55
-60
0
150
300
450
600
750
900
1050
1200
1350
1500
1650
1800
X (M)
LANE 17
LANE 18
LANE 19
LANE 20

6·3E

CORNFIELD SHOALS
JULY 30, 1978
LANE INTERVAL - 50M
VERTICAL EXAGGERATION - 15X

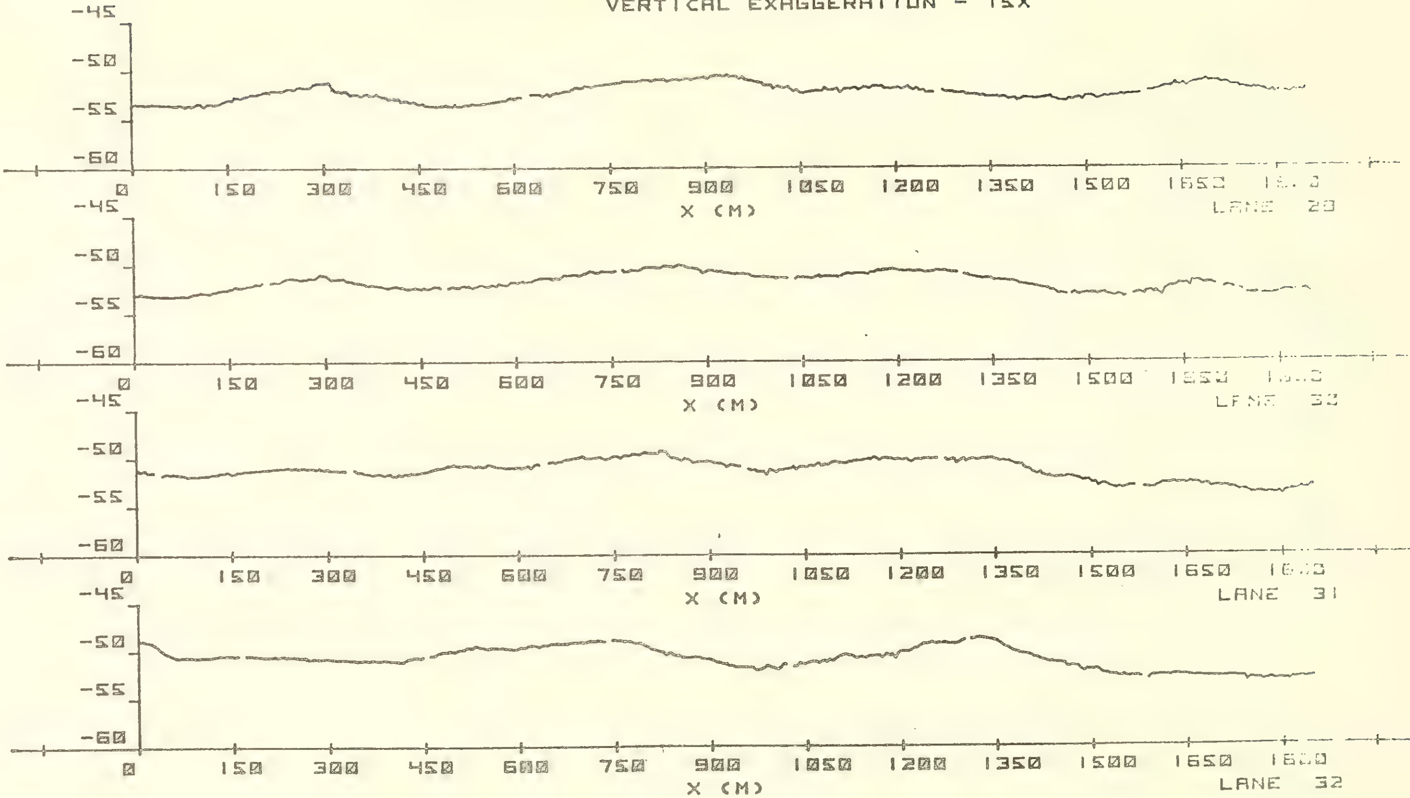


CORNFIELD SHOALS
JULY 30, 1978
LANE INTERVAL - 50M
VERTICAL EXAGGERATION - 15X

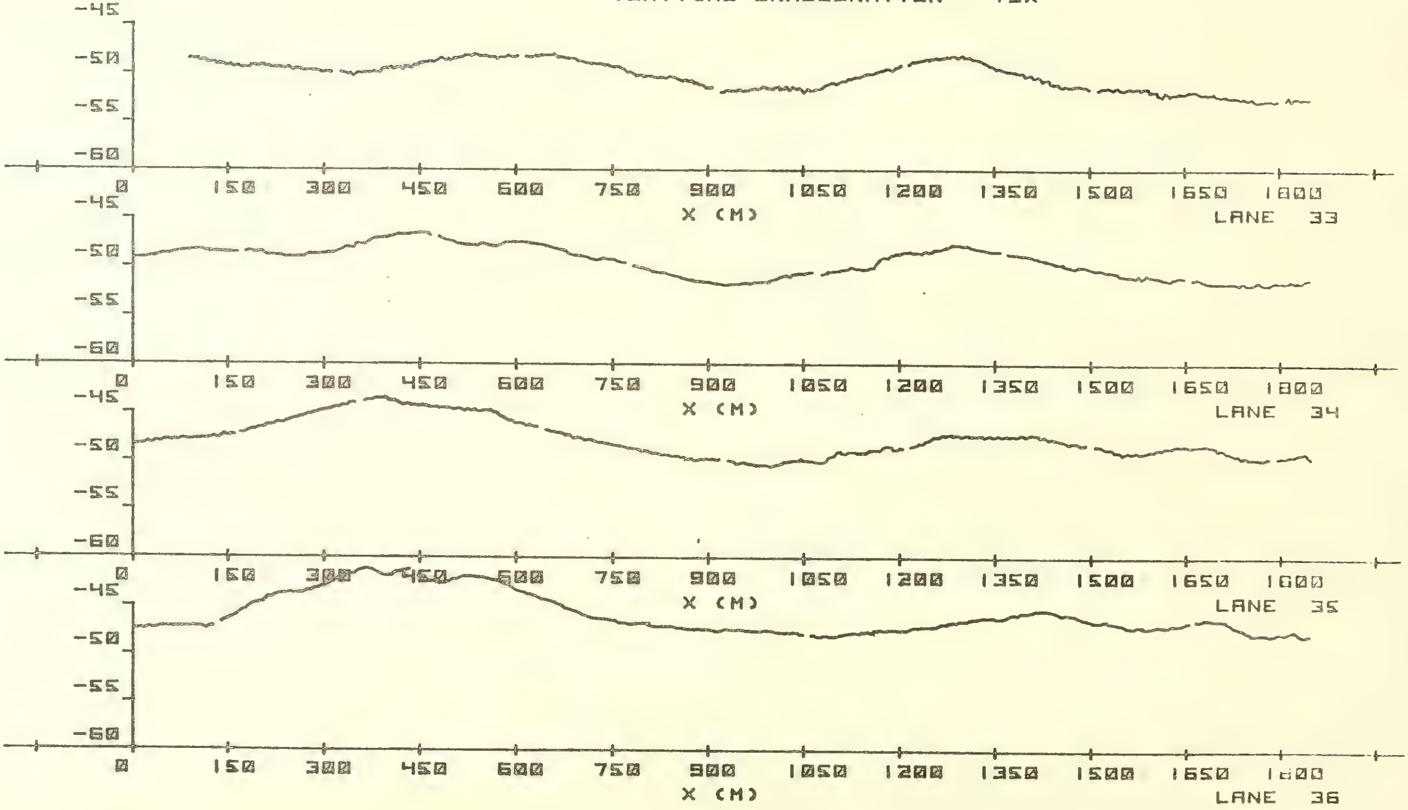


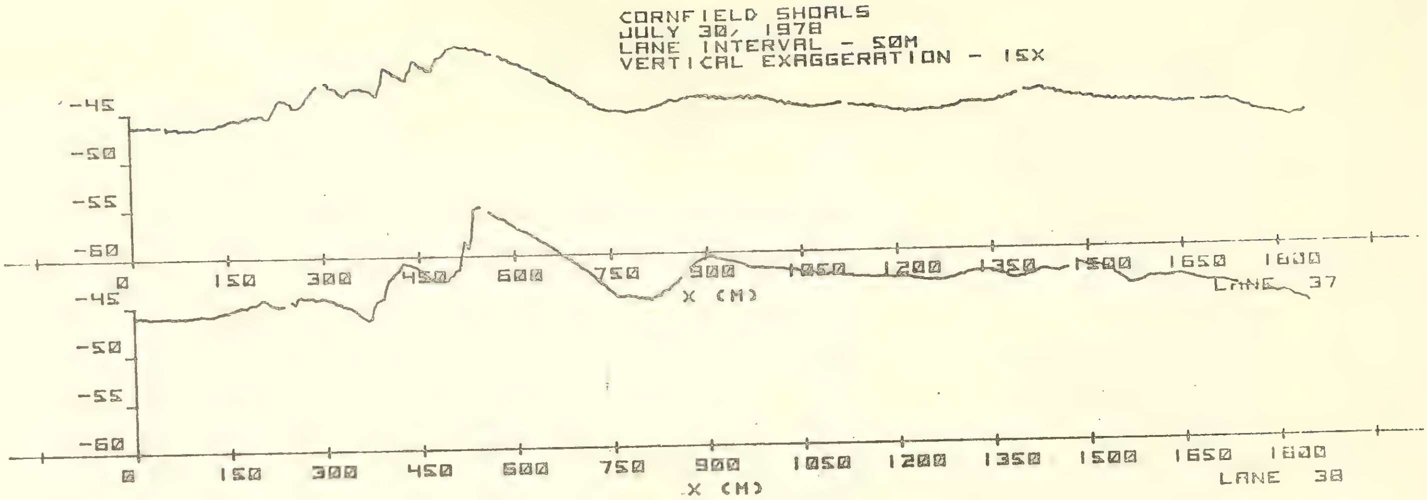
6-3H

CORNFIELD SHOALS
JULY 30, 1978
LANE INTERVAL - 50M
VERTICAL EXAGGERATION - 15X



CORNFIELD SHOALS
JULY 30, 1978
LANE INTERVAL - 50M
VERTICAL EXAGGERATION - 15X





CORNFIELD SHOALS
JULY 30, 1978
LANE INTERVAL - 50M
VERTICAL EXAGGERATION - 15X

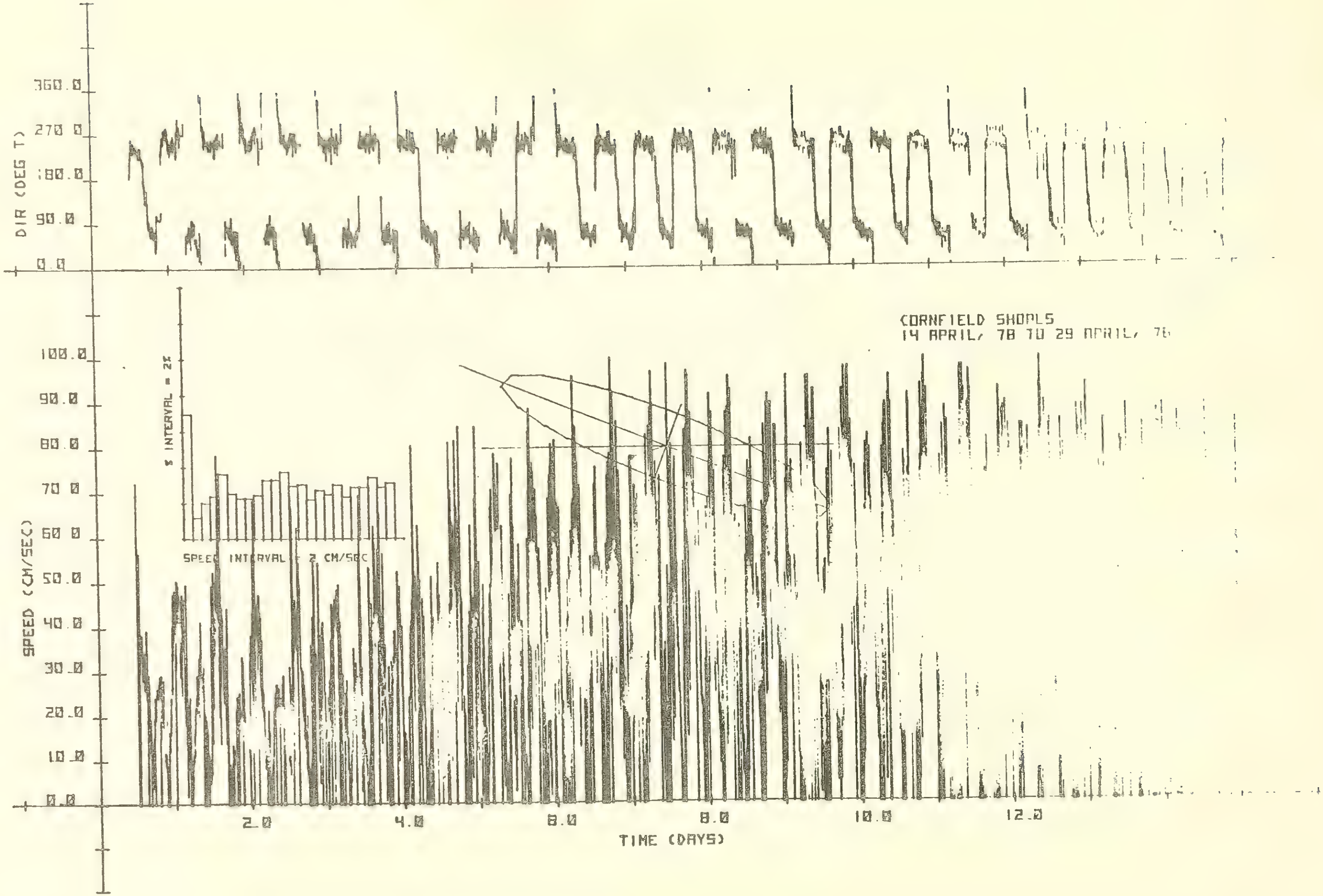
Currents

Current data for the Cornfield Shoals disposal site are presented in Figure G-4(a-d) and Table G-1. It is apparent from the speed-direction versus time record that the current meter was not operating in a normal manner. The data consists of spikes resulting from a misalignment of the tape head in the recording device, however, the tidal component of the current can be resolved from these data and is in fact presented in Table G-1.

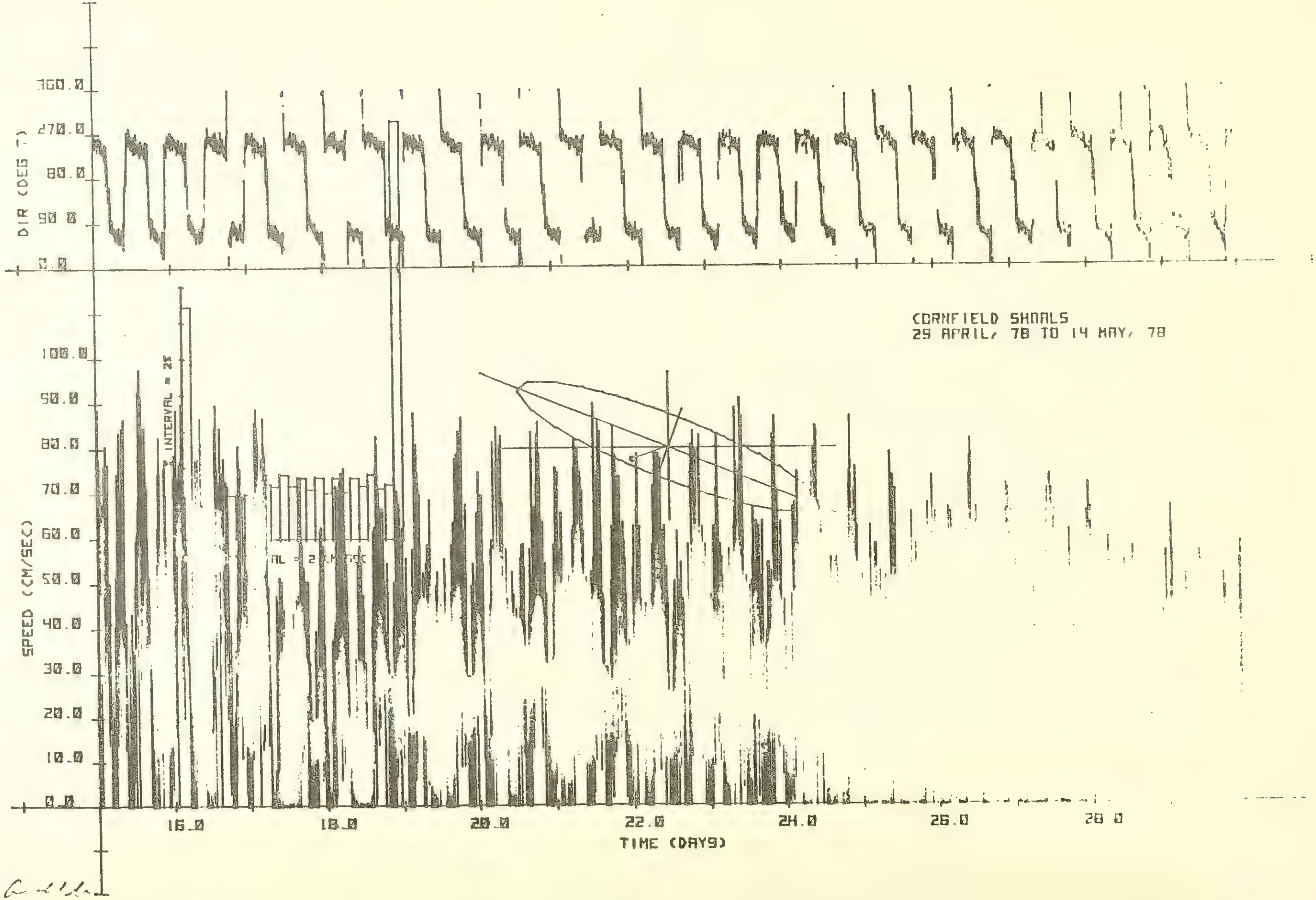
TABLE G-1

	Total OBS. Current	Tidal Current Inc. Mean	Residual Current	Mean Current
Semi-major axis (cm/sec)	33.7	22.73 ≈ 1.89	26.21	-
Semi-minor axis (cm/sec)	7.6	1.79	7.36	-
Direction (°T)	111	110	111	-
Horizontal Kinetic energy (dynes/sec)	595.95	259.89	370.57	34.59
10% Highest speeds (cm/sec)	N.A.	-	-	-
Peak speed (cm/sec)	-	44.58	-	-
Average maximum speed (cm/sec)	-	32.24 / 6a	-	-

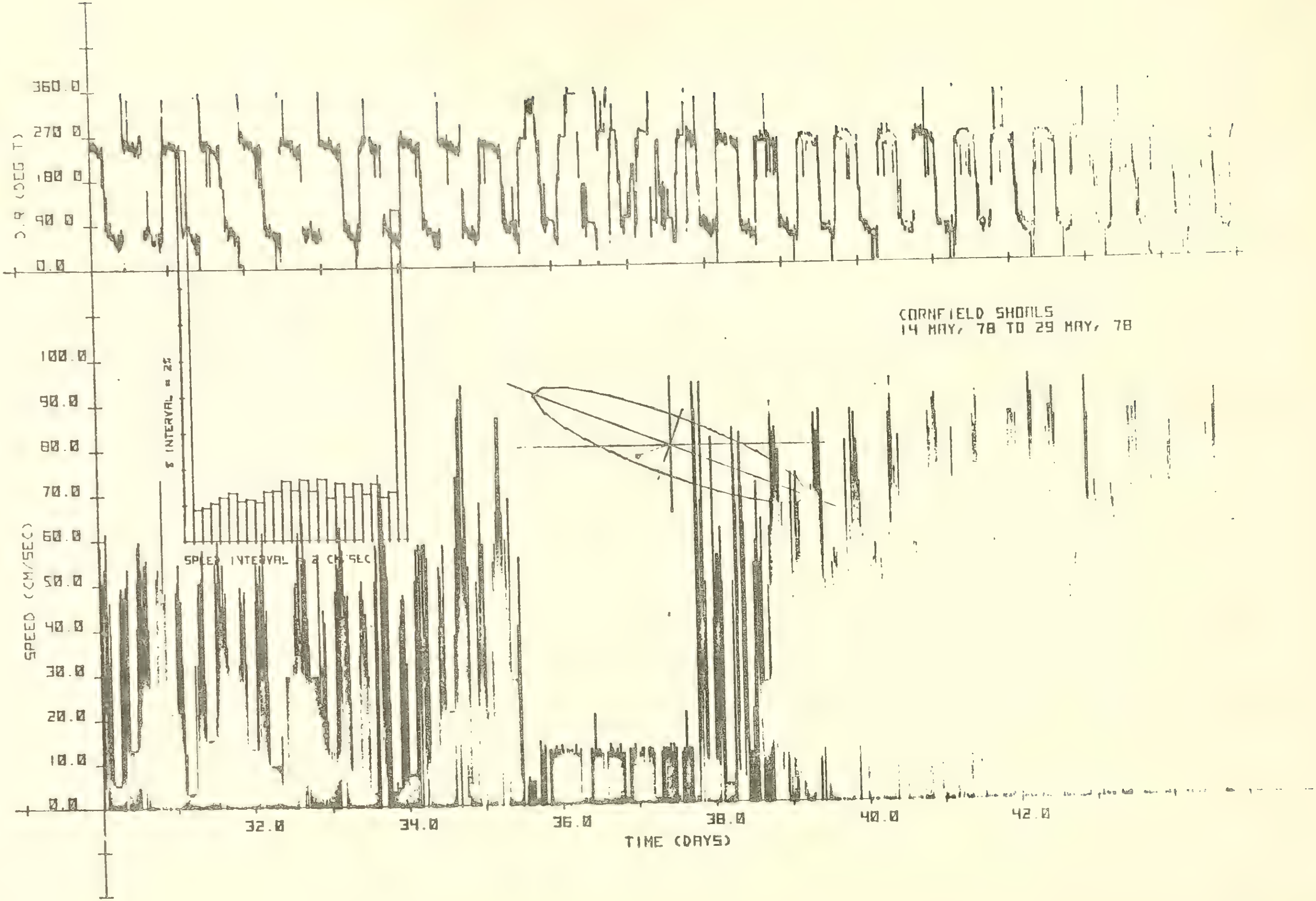
The tidal component of the current at Cornfield Shoals has a kinetic energy of 260 dynes/sec that is almost identical to the tidal energy at the New London


CORNFIELD SHOALS
14 APRIL, 78 TO 29 APRIL, 78
DIR (DEG T)
360.0
270.0
180.0
90.0
0.0
SPEED (CM/SEC)
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
% INTERVAL = 2%
SPEED INTERVAL = 2 CM/SEC
2.0
4.0
6.0
8.0
10.0
12.0
TIME (DAYS)

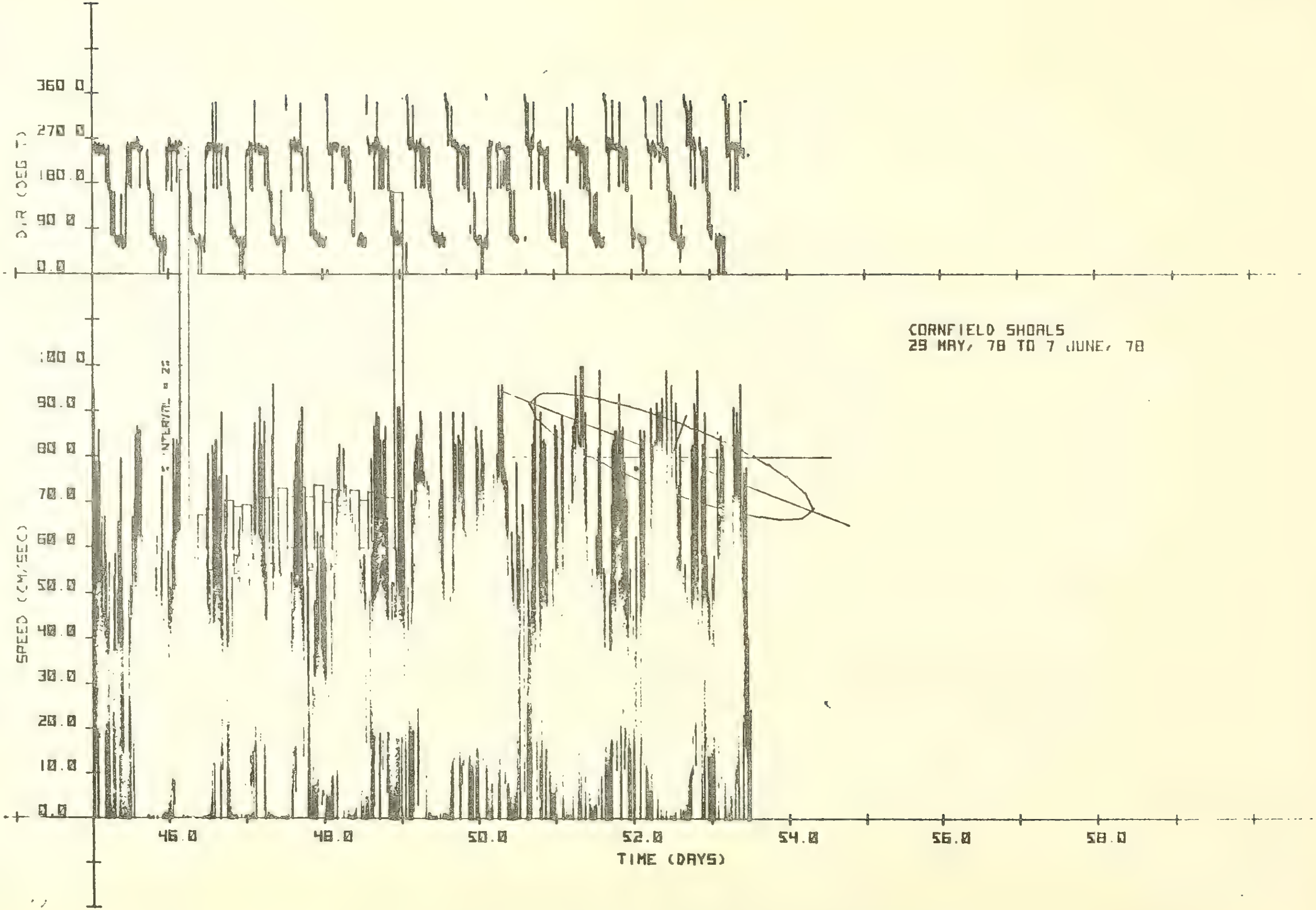
G 4A



CORNFIELD SHOALS
29 APRIL, 78 TO 14 MAY, 78


CORNFIELD SHOALS
14 MAY, 78 TO 29 MAY, 78

G-4C


CORNFIELD SHOALS
29 MAY, 78 TO 7 JUNE, 78
DIR (DEG T)
360.0
270.0
180.0
90.0
0.0
SPEED (CM/SEC)
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
INTERVAL = 20
46.0
48.0
50.0
52.0
54.0
56.0
58.0
TIME (DAYS)

G-4D

site. Since, the spoils at New London are relatively stable, it is puzzling to find no physical evidence of spoils at Cornfield Shoals. It may be that the residual current component at Cornfield Shoals is significantly greater than that at New London, however, better data are required before that can be determined.

Sediments

Heavy metal analysis of sediments from the Cornfield Shoals disposal site are presented in Table G-2. Although most samples at this site are among the cleanest found in the entire New England study area, two samples from the point of dumping (Corn DS-2, from March and July) have extremely high concentrations and enrichment relative to iron. Thus, it is apparent that although no spoil mound has been formed at this site, spoils are present in the area as isolated patches. Future sampling will be oriented toward determing the extent and distribution of this spoil. The impact and extent of this and future dumping should be readily discernable because of the great difference in composition between spoils and surrounding sediments.

Biochemical Studies

At the Cornfield Shoals disposal site and reference station *Mytilus edulis* collected on January 16, 1978 from Latimer's Light were placed on the mussel cages and used to construct the 95% confidence limits for statistical analysis. The cage at the disposal site was located at 41° 12' 37.4"N, 72° 21'56"W and the reference station was located approximately 1 mile north of the site at 41° 13'44.1' N, 72° 22' 24.1" W in 30 meters of water south of Long Sand Shoal.

The baseline data from Latimer's Light and results obtained from samples at the sites are presented in Table G-3 and Figure G-5. With the exception of

TABLE G-2a

SAMPLE LOCATIONS

SITE: Cornfield

	DISPOSAL SITE:				REFERENCE SITE		
DATE	CURRENT METER	MUSSELS	BENTHIC SAMPLES		MUSSELS	BENTHIC SAMPLES	
			DREDGES	GRABS		DREDGES	GRABS
31/July/1978			41°12'32.2" 72°21'36.6"	No Posit.		41°13'32.2" 72°22'11.8"	
31/Jan/1978	41°12'43.3" 72°21'59.8"	41°12'37.4" 72°21'56.0"			41°13'44.1" 72°22'24.1"		

Cornfield Shoals

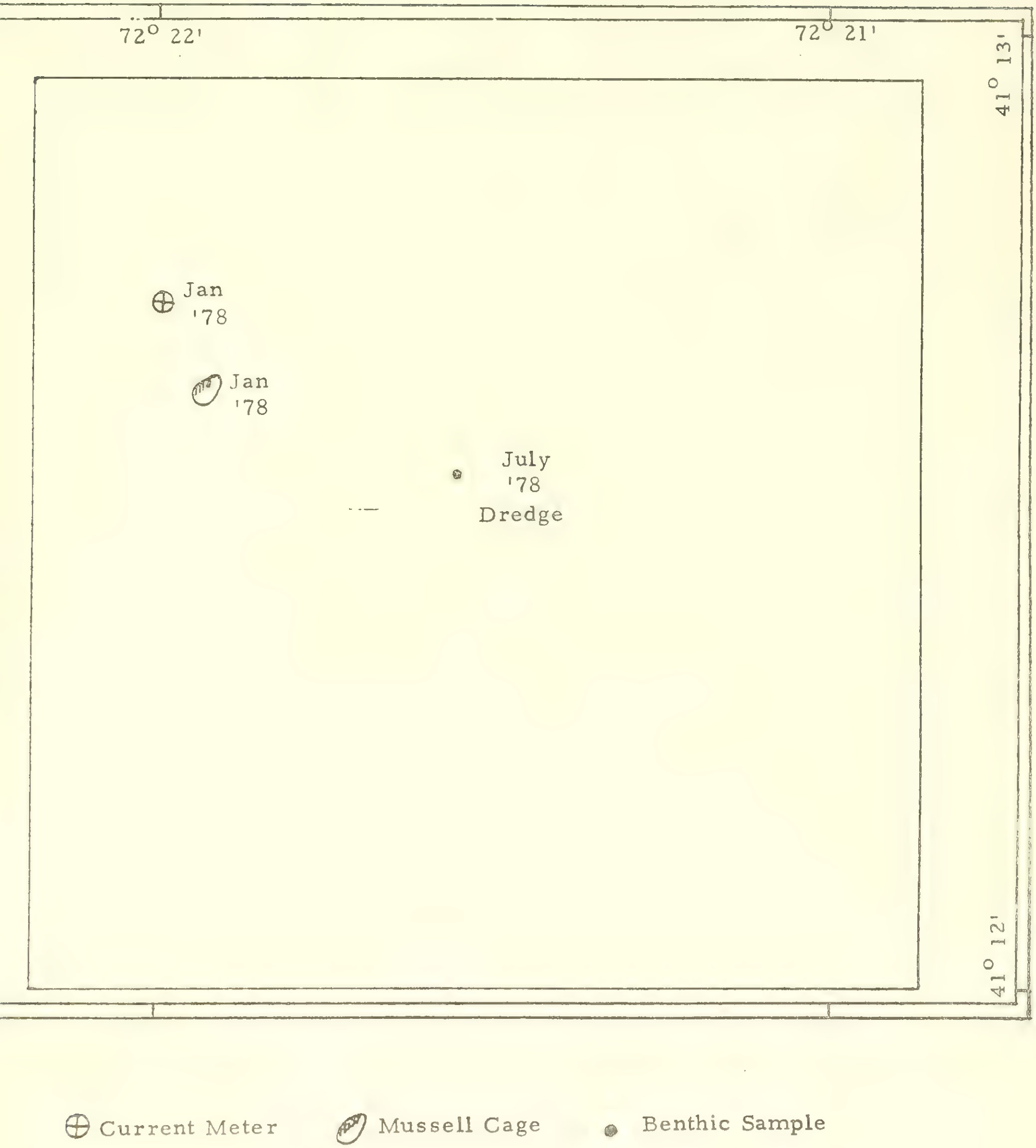


TABLE G-2

SURFACE SEDIMENT ANALYSIS

CORNFIELD SHOAL CT.

SAMPKING	Cd	Co	Cr	Cu	Fe*	Hg	Ni	Pb	Zn	Vol/Sol	Oil/Grease
	All metals ppm									(%)	(ppm x 10^3)
MAR/APR 1978											
CORN CS	.12	2.9	5.6	2.8	.66	.01	21	8.9	28	.93	.05
CORN DS 1 dump	.11	2.6	8.1	4.3	.45	.07	18	4.5	28	1.1	7.6
CORN DS 2 dump	1.7	7.3	56	59	1.5	.29	41	52	144	7.0	3.0
CORN DS 3 dump	.12	5.3	6.3	4.6	.82	.04	38	14	35	5.2	1.4
CORN NM 2	.24	5.1	6.8	9.4	.66	.04	39	14	28	5.5	.35
CORN SM 4	.25	3.7	6.3	5.8	.62	.02	21	11	24	2.7	nil
CORN WM 5	.12	2.9	6.5	4.0	.42	.16	13	5.8	22	.9	nil
ERROR %	25	9	5	7	3	14	5	13	15	5	15
JULY 1978											
CORN 1	.37	4.4	30	15	1.0	.05	14	12	53	5.0	.61
CORN 2	4.0	8.5	93	82	1.6	.64	31	83	281	24	6.3
CORN Ref 1	.25	2.4	11	1.7	.56	nil	6.1	7.5	27	1.7	.52

*All Fe values multiply by 10^4

Table G-3. Heavy Metal Concentrations (ppm) in *Mytilus edulis* from Latimer's Light deployed at Cornfield Shoals, New Haven, WLIS and Cable and Anchor Reef Disposal sites (Southern New England).

Date	Location		Cd	Cr	Cu	Hg	Pb	Zn
1-16-78	Latimer's	$\bar{x}$	2.18	4.34	10.80	0.210	8.58	162
	Light	S.D.	0.32	0.50	0.54	0.028	1.61	23
4-10-78		$\bar{x}$	2.06	7.71	8.53	0.199	5.17	110
		S.D.	0.46	2.88	0.38	0.027	2.29	45
8-9-78		$\bar{x}$	1.37	2.45	8.68	0.169	5.52	112
		S.D.				0.009	1.44	
4-14-78	Cornfield	$\bar{x}$	1.84	1.59	14.03	0.247	0.53	184
	Shoals	S.D.	0.25	1.10	0.40	0.027	0.13	10
	Reference Site							
8-2-78		$\bar{x}$	1.80	2.84	8.03	0.165	1.47	144
		S.D.	0.17		0.44	0.014	1.48	38

TABLE G-4

DAMOS BENTHOS - TABLE OF NUMERIC DENSITY DATA

CORNFIELD SHOAL DUMP SITE - 31 JANUARY 1978

PREDOMINANT SPECIES	DREDGE NUMBER #1	#2	#3	TOTAL	MEAN	STANDARD DEVIATION	COEFF. OF DISPERSION	95 PERCENT CONF. LIMITS OF MEAN	NUMERIC RANK	% OF TOTAL	CUMUL. % OF TOTAL
1. Anthozoan sp.	0	0	5	5	1.7	2.9	4.9	0-8.9	1	55.6	55.6
2. Anachis lafresnayi	0	1	0	1	0.3	0.6	1.1	0-1.8	2	11.1	66.7
3. Lunatia heros	1	0	0	1	0.3	0.6	1.1	0-1.8	2	11.1	77.8
4. Nassarius trivittatus	0	0	1	1	0.3	0.6	1.1	0-1.8	2	11.1	88.9
5. Urosalpinx cinerea	0	1	0	1	0.3	0.6	1.1	0-1.8	2	11.1	100.0
TOTAL	1	2	6	9	3.0	2.6	2.3	0-9.5			
TOTAL # OF SPP PER DREDGE	1	2	2	5	1.7	0.6		0.2-3.2			
SPECIES DIVERSITY (H')	0	0.69	0.45	1.14	0.38	0.35					
EQUITABILITY (J')	0	1.00	0.65	1.65	0.55	0.51					

TOTAL # OF INDIVIDUALS THIS STATION = 9

TABLE G-5

DAMOS BENTHOS - TABLE OF NUMERIC DENSITY DATA

CORNFIELD SHOAL REFERENCE STATION - 31 JANUARY 1978

PREDOMINANT SPECIES	DREDGE NUMBER #1	#2	#3	TOTAL	MEAN	STANDARD DEVIATION	COEFF. OF DISPERSION	95 PERCENT CONF. LIMITS OF MEAN	NUMERIC RANK	% OF TOTAL	CUMUL. % OF TOTAL
1. Mytilus edulis	0	0	18	18	6.0	10.4	18.0	0-31.8	1	20.2	20.2
2. Nassarius trivittatus	0	12	5	17	5.7	6.0	6.4	0-20.6	2	19.1	39.3
3. Anachis lafresnayi	0	0	7	7	2.3	4.0	7.1	0-12.2	3	7.9	47.2
4. Crepidula plana	0	0	5	5	1.7	2.9	4.9	0- 8.9	4	5.6	52.8
5. Pherusa affinis	0	0	3	3	1.0	1.7	3.0	0- 5.2	5	3.4	56.2
6. Pagurus longicornis	0	0	3	3	1.0	1.7	3.0	0- 5.2	5	3.4	59.6
7. Echinarachnius parma	0	3	0	3	1.0	1.7	3.0	0- 5.2	5	3.4	63.0
8. Tellina agilis	0	0	2	2	0.7	1.2	1.9	0- 3.7	6	2.2	65.2
9. Unicola irrorata	0	0	2	2	0.7	1.2	1.9	0- 3.7	6	2.2	67.4
10. Amphipolis squamata	0	0	2	2	0.7	1.2	1.9	0- 3.7	6	2.2	69.6
TOTAL	0	15	47	62	20.7	24.0	27.8	0-80.3			
TOTAL # OF SPP PER DREDGE	0	2	18	18	6.7	9.9		0-31.2			
SPECIES DIVERSITY (H')	0	0.50	2.33	2.83	0.94	1.23					
EQUITABILITY (J')	0	0.72	0.81	1.53	0.51	0.44					

TOTAL # OF INDIVIDUALS THIS STATION = 89

TABLE G-4

DAMOS BENTHOS - TABLE OF NUMERIC DENSITY DATA

CORNFIELD SHOAL DUMP SITE - 31 JANUARY 1978

PREDOMINANT SPECIES	DREDGE NUMBER #1	#2	#3	TOTAL	MEAN	STANDARD DEVIATION	COEFF. OF DISPERSION	95 PERCENT CONF. LIMITS OF MEAN	NUMERIC RANK	% OF TOTAL	CUMUL. % OF TOTAL
1. Anthozoan sp.	0	0	5	5	1.7	2.9	4.9	0-8.9	1	55.6	55.6
2. Anachis lafresnayi	0	1	0	1	0.3	0.6	1.1	0-1.8	2	11.1	66.7
3. Lunatia heros	1	0	0	1	0.3	0.6	1.1	0-1.8	2	11.1	77.8
4. Nassarius trivittatus	0	0	1	1	0.3	0.6	1.1	0-1.8	2	11.1	88.9
5. Urosalpinx cinerea	0	1	0	1	0.3	0.6	1.1	0-1.8	2	11.1	100.0
TOTAL	1	2	6	9	3.0	2.6	2.3	0-9.5			
TOTAL # OF SPP PER DREDGE	1	2	2	5	1.7	0.6		0.2-3.2			
SPECIES DIVERSITY (H')	0	0.69	0.45	1.14	0.38	0.35					
EQUITABILITY (J')	0	1.00	0.65	1.65	0.55	0.51					

TOTAL # OF INDIVIDUALS THIS STATION = 9

TABLE G-5

DAMOS BENTHOS - TABLE OF NUMERIC DENSITY DATA

CORNFIELD SHOAL REFERENCE STATION - 31 JANUARY 1978

PREDOMINANT SPECIES	DREDGE NUMBER #1	#2	#3	TOTAL	MEAN	STANDARD DEVIATION	COEFF. OF DISPERSION	95 PERCENT CONF. LIMITS OF MEAN	NUMERIC RANK	% OF TOTAL	CUMUL. % OF TOTAL
1. Mytilus edulis	0	0	18	18	6.0	10.4	18.0	0-31.8	1	20.2	20.2
2. Nassarius trivittatus	0	12	5	17	5.7	6.0	6.4	0-20.6	2	19.1	39.3
3. Anachis lafresnayi	0	0	7	7	2.3	4.0	7.1	0-12.2	3	7.9	47.2
4. Crepidula plana	0	0	5	5	1.7	2.9	4.9	0- 8.9	4	5.6	52.8
5. Pherusa affinis	0	0	3	3	1.0	1.7	3.0	0- 5.2	5	3.4	56.2
6. Pagurus longicornis	0	0	3	3	1.0	1.7	3.0	0- 5.2	5	3.4	59.6
7. Echinarachnius parma	0	3	0	3	1.0	1.7	3.0	0- 5.2	5	3.4	63.0
8. Tellina agilis	0	0	2	2	0.7	1.2	1.9	0- 3.7	6	2.2	65.2
9. Unicola irrorata	0	0	2	2	0.7	1.2	1.9	0- 3.7	6	2.2	67.4
10. Amphipolis squamata	0	0	2	2	0.7	1.2	1.9	0- 3.7	6	2.2	69.6
TOTAL	0	15	47	62	20.7	24.0	27.8	0-80.3			
TOTAL # OF SPP PER DREDGE	0	2	18	18	6.7	9.9		0-31.2			
SPECIES DIVERSITY (H')	0	0.50	2.33	2.83	0.94	1.23					
EQUITABILITY (J')	0	0.72	0.81	1.53	0.51	0.44					

TOTAL # OF INDIVIDUALS THIS STATION = 89

Cr and Cu which show a significant increase in their concentrations during April 1978, there is no discernable change in the concentrations of Cd, Hg, and Zn. However, significant decreases are observed in the concentrations of Pb (disposal area) and Cr (disposal and reference area) for the April and August samples.

Benthic Macrofauna

Tables G-4 and G-5 present numeric density data for the Cornfield Shoals disposal site and reference station. Obviously the lack of individuals at the disposal site prohibits use of these data for more than a cursory look at the population. It may be that patchiness in the benthic population has biased these results.

Fisheries

Since no lobster buoys or commercial or sport fishing activity have been seen at this site during DAMOS investigations it was given low priority for fisheries mapping. Mapping will be completed during the next month along with the New London site.

Pratt (1977) found beds of blue mussels on the stable bottoms of the dump site and central depressions. Many other invertebrates took advantage of the food and shelter which these beds offer. Lobsters and finfish would find abundant food here and it is possible that fisheries are carried out during some part of the year.

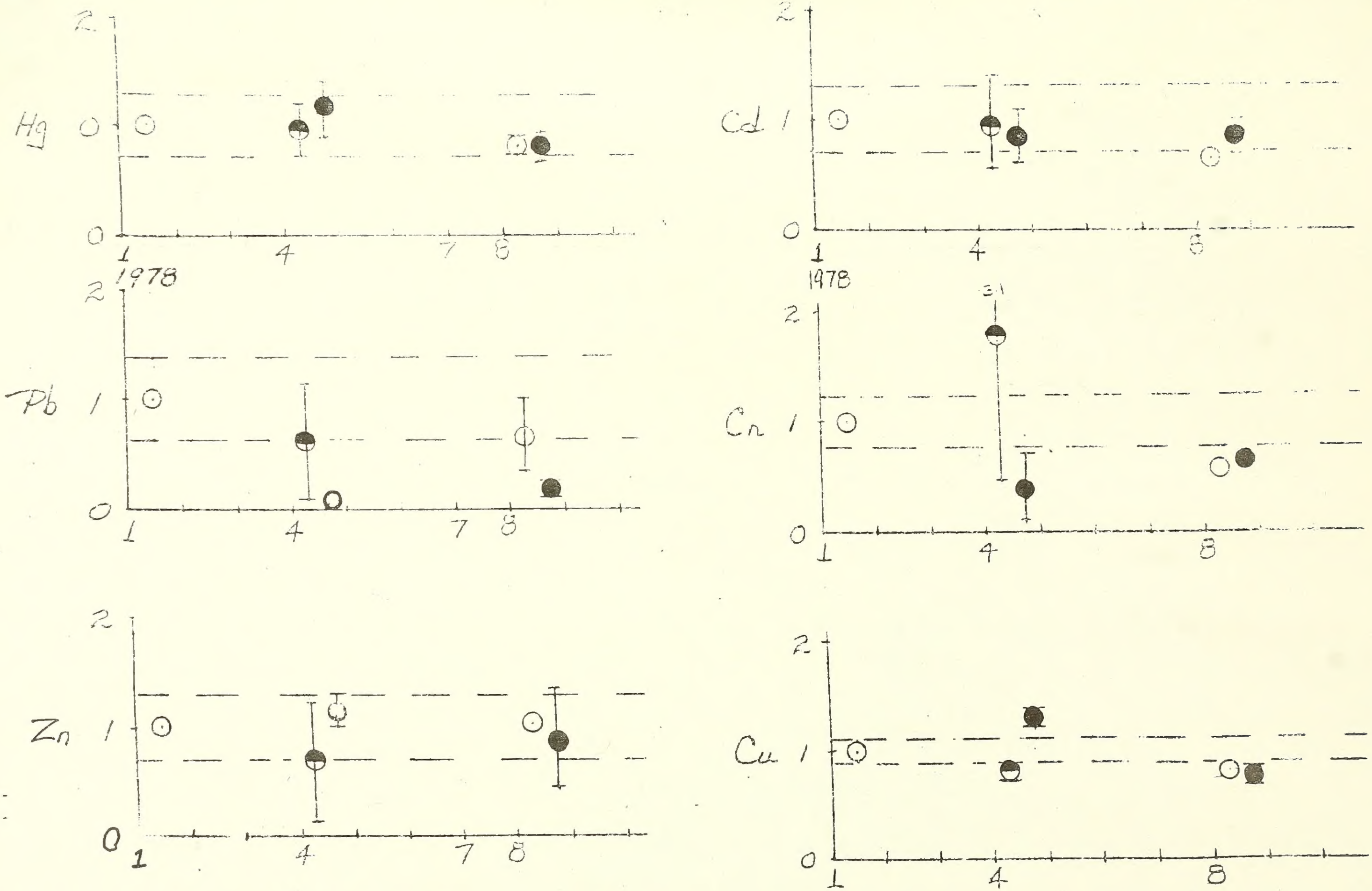


Figure G-6. Temporal variation in the ratios of heavy metals in Mytilus edulis from Latimer's Light (0) deployed at Cornfield Shoals reference site (0). Broken lines represent the 95% confidence limits of the baseline data.